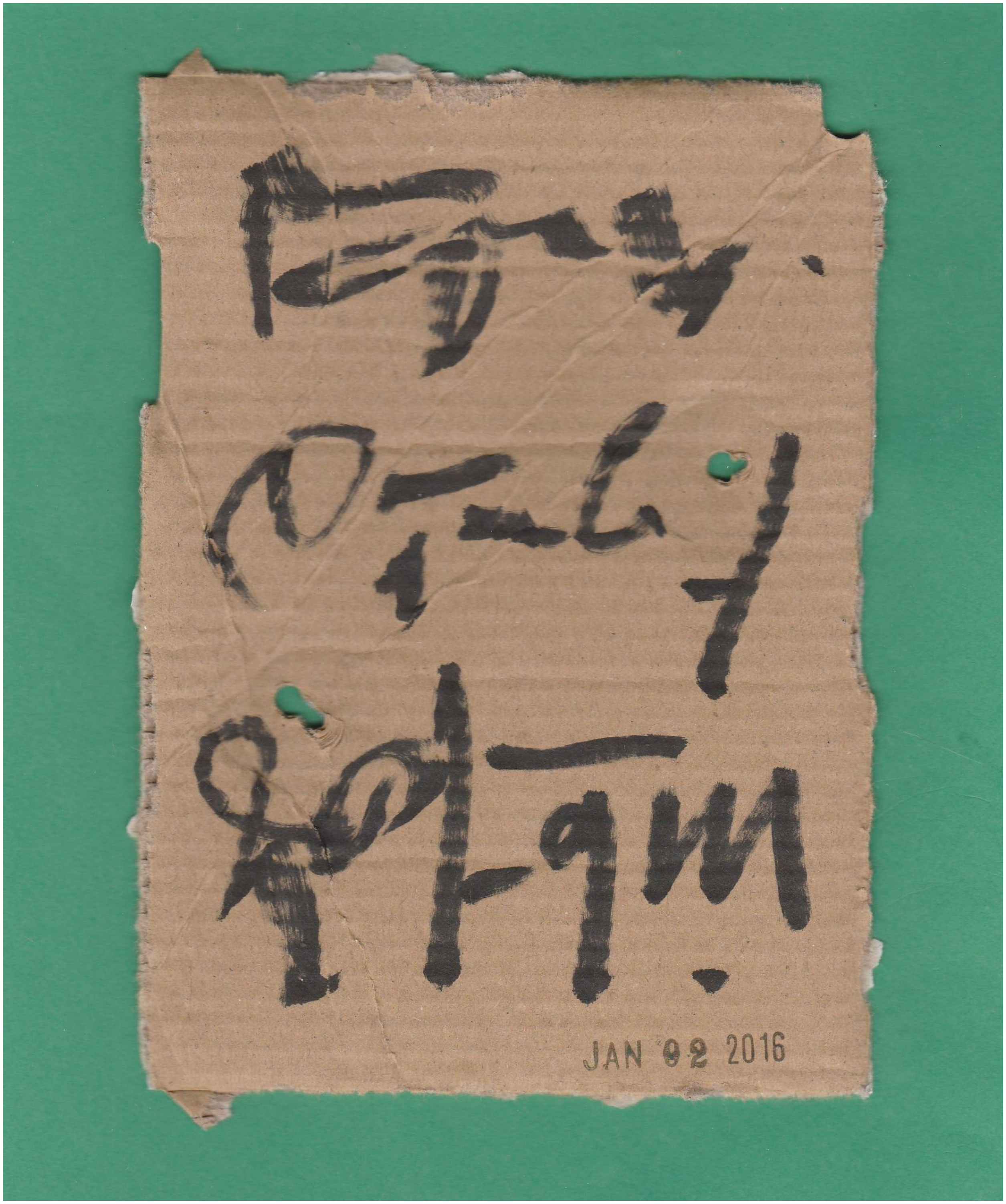
jim leftwich

visual poems ongoing research 2016 -vol. 2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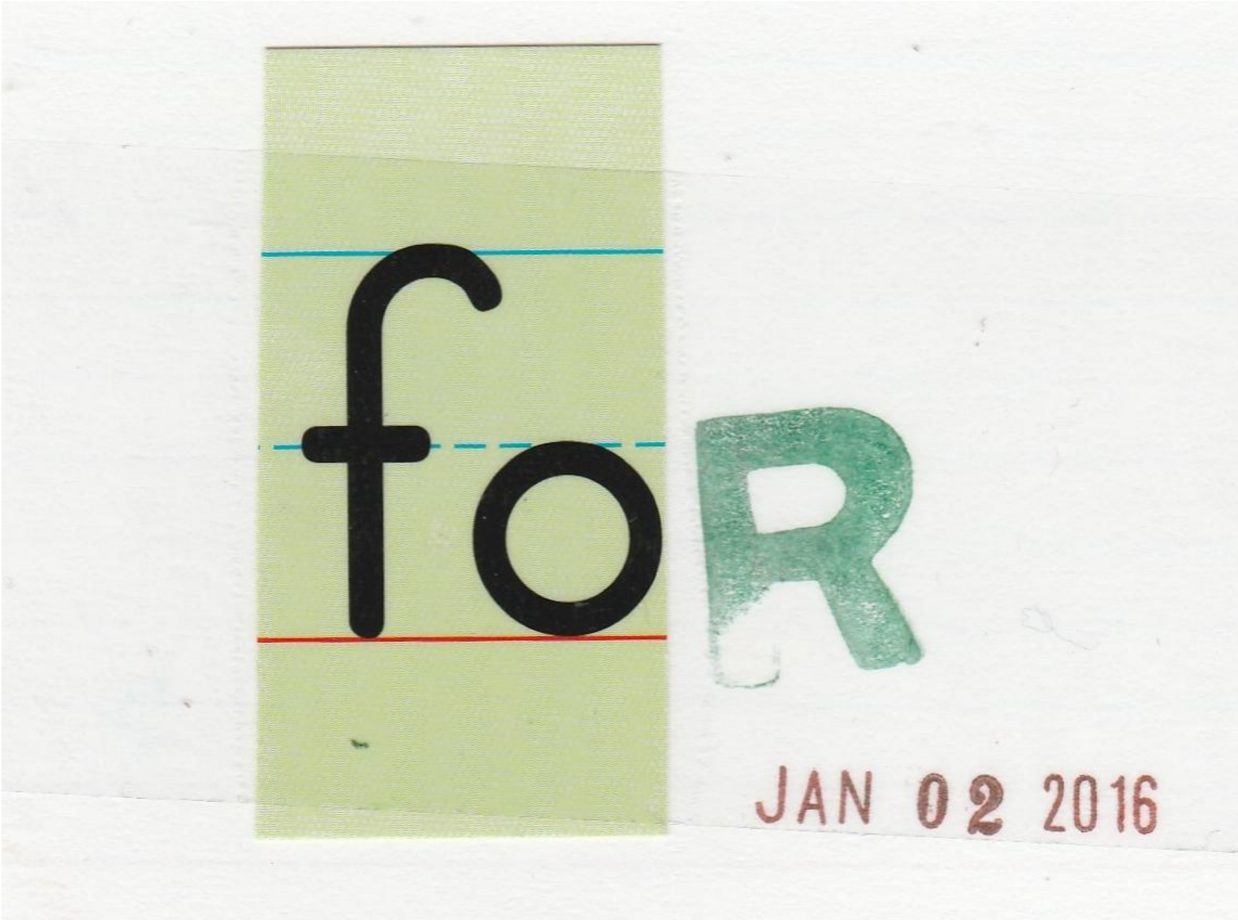
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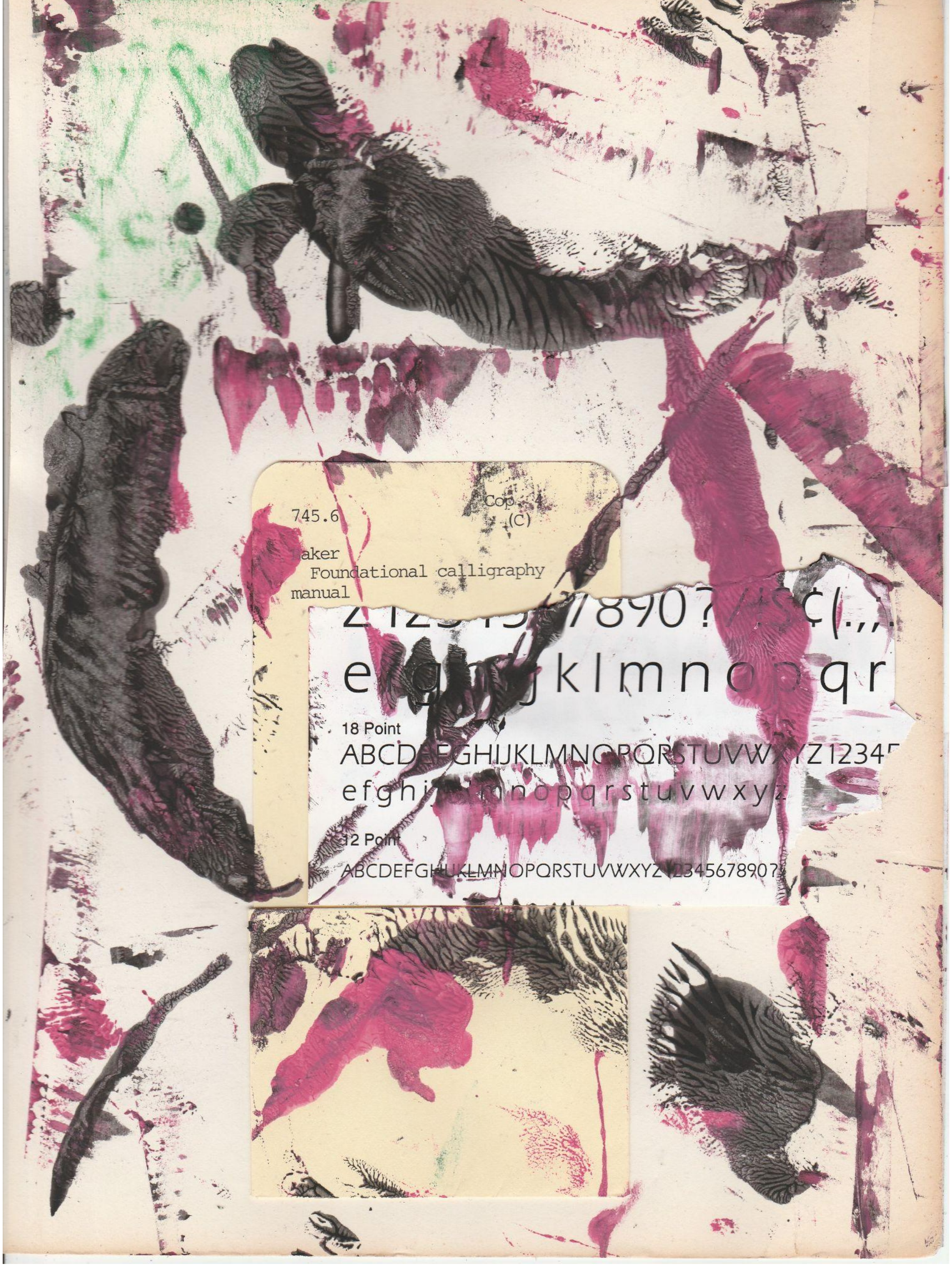
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information, such as gambling.[3]

In 1958, Klaus Conrad published a monograph titled *Die beginnende Schizophrenie. Versuch einer Gestaltanalyse des Wahns* ("The onset of schizophrenia: an attempt to form an analysis of delusion"),[1] in which he described in groundbreaking detail the prodromal mood and earliest stages of schizophrenia. He coined the word "Apophänie" to characterize the onset of delusional thinking in psychosis. Conrad's theories on the genesis of schizophrenia have since been partially, yet inconclusively, confirmed in psychiatric literature when tested against empirical findings.[4]

Conrad's neologism was translated into English as "apophenia" (from the Greek *apo* [away from] + *phaenein* [to show]) to reflect the fact that a schizophrenic initially experiences delusion as revelation.[5]

In contrast to an epiphany, an apophany (i.e., an instance of apophenia) does not provide insight into the nature of reality or its interconnectedness but is a "process of repetitively and monotonously experiencing abnormal meanings in the entire surrounding experiential field". Such meanings are entirely self-referential, solipsistic, and paranoid — "being observed, spoken about, the object of eavesdropping, followed by strangers".[6] Thus the English term "apophenia" has a somewhat different meaning than that which Conrad defined when he coined the term "Apophänie".

"Apophany" should not be confused with "apophasy".

Related neologisms

"Patternicity"

In 2008, Michael Shermer coined the word "patternicity", defining it as "the tendency to find meaningful patterns in meaningless noise".[7][8]

"Agenticity"

In *The Believing Brain* (2011), Shermer wrote that humans have "the tendency to infuse patterns with meaning, intention, and agency", which he called "agenticity".[9]

"Randomania"

In 2011, parapsychologist David Luke proposed that apophenia is one end of a spectrum and that the opposite behaviour (attributing to chance what are apparently patterned or related data) can be called "randomania". He asserted that dream precognition is real and that randomania is the reason why some people dismiss it.[10]

Examples

Pareidolia

pollinatiᵒl 'mō-shən\
otion that continues indefinitely
of energy. Such motion can oc-
the a. in a frictionless medium and no
often
spore. PERPETUAL MOTION *have failed.*
POLLI ...lows a de-
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between the computed orbit of a
pollin rved orbit, caused by gravitational
BOT. celestial body. 2. PHYSICS. The de-
wate predicted path, due to some cause ... pistil by wind, breeders.
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floral envelope of a flower. A
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polyconic ... on\
EARTH S *f a* PETAL *may be adaptations* ... urface. Lines on
the ma *ıd birds.* ... e spaced in pro-
portion ... ce, each parallel
is a cur ... gent to the earth
at that ı leaf to a stem. 2. ZOOLOGY. A ... rs as a straight
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becaus n. ... *m the central*
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or a stonelike substance and by
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areas ... n moisture or chemicals
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Foods been infiltrated by silica, which POLYETHYLENE.
ial cell by cell. Petrified wood is
polygon llen logs, tree trunks and stumps
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the s ... more segments have a
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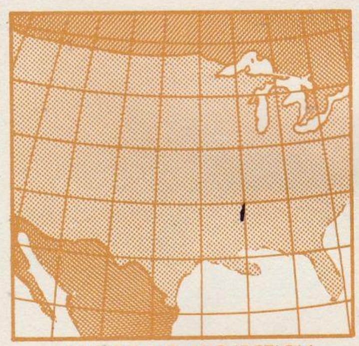
POLYCONIC PROJECTION

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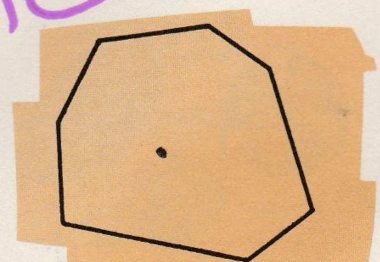
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jim leftwich
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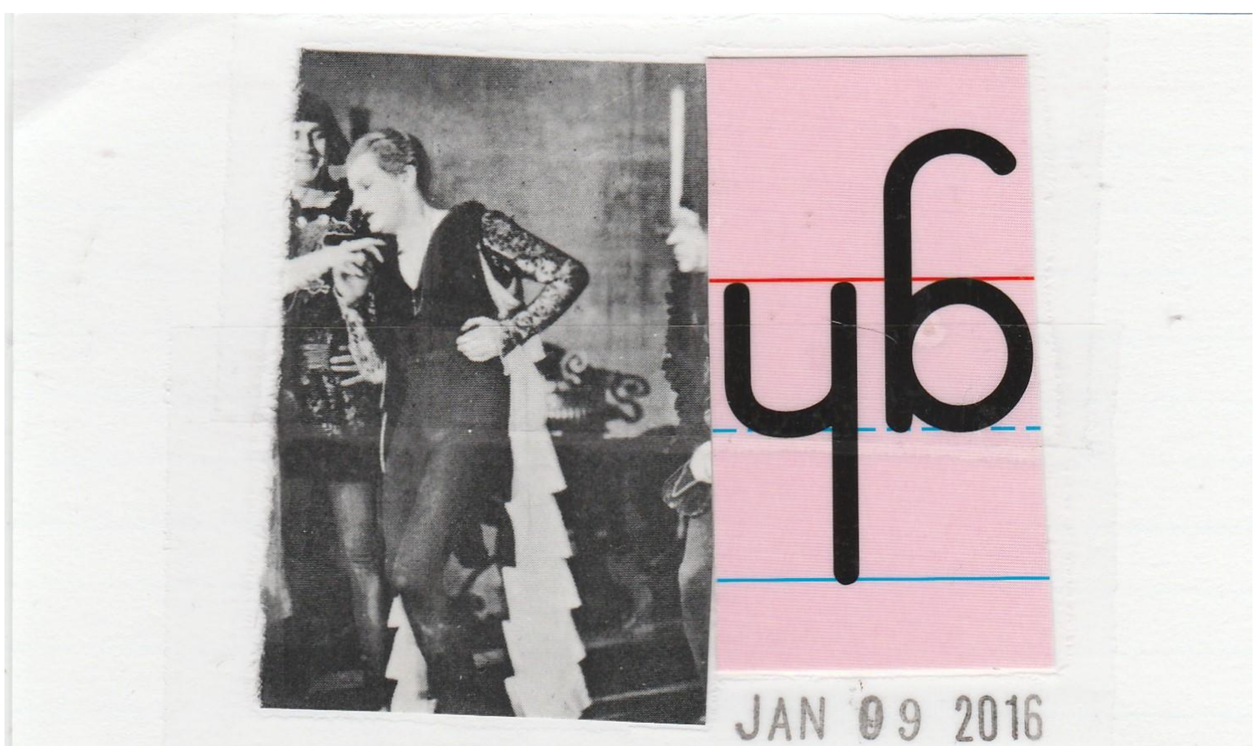
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525 10th st sw
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original
topped with sea salt
www.bandittapegun.com
1-877-621-4125
comments@bandittapegun.com
Bandit
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nuclear rocket \'n(y)ü-klē-ər 'räk-ət\
ASTRONAUTICS. A reaction-type pow
reactor to heat a gas to high temperatures.
gas through a nozzle; also, theoretically, a r
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fusion to provide thrust.
A NUCLEAR ROCKET is more economical in it
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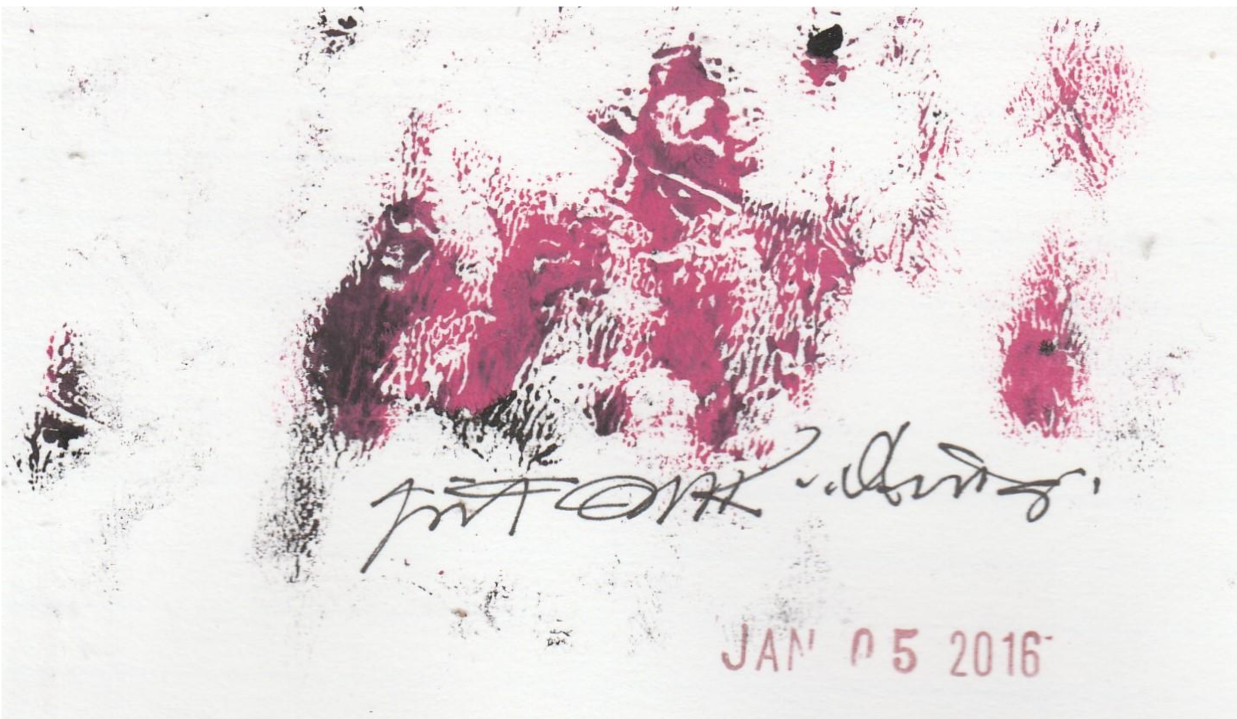
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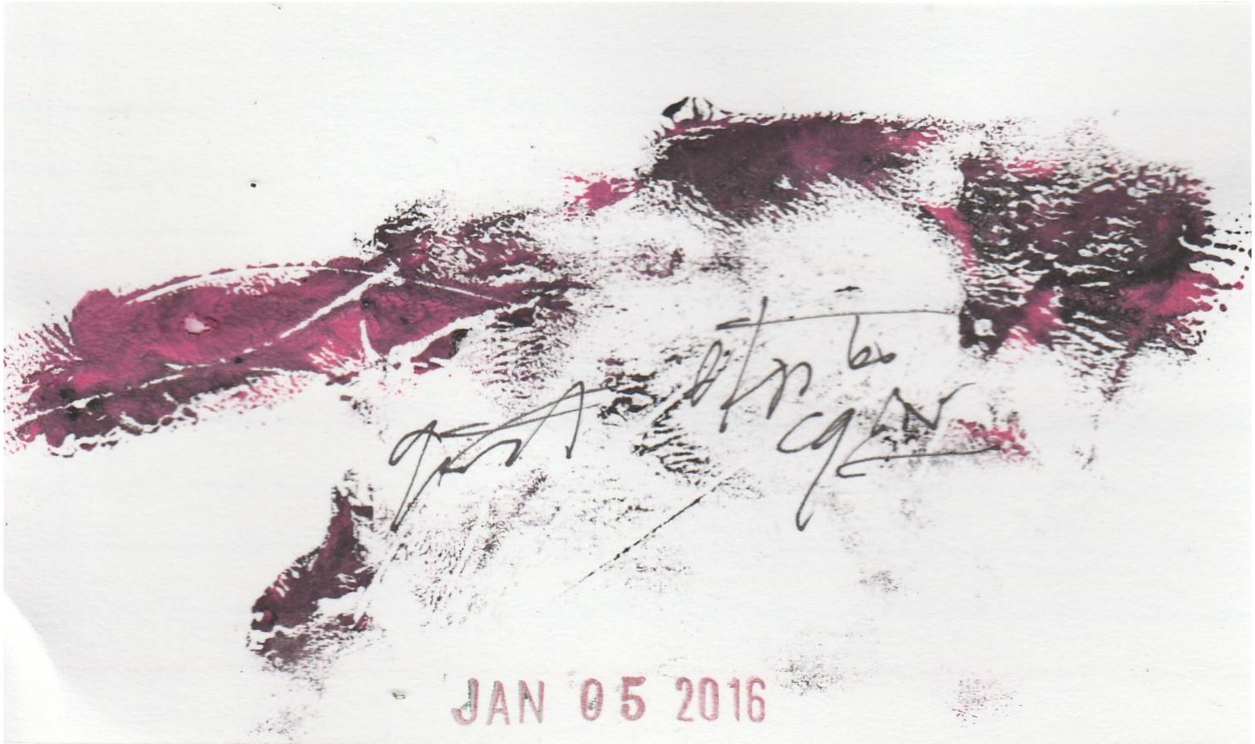
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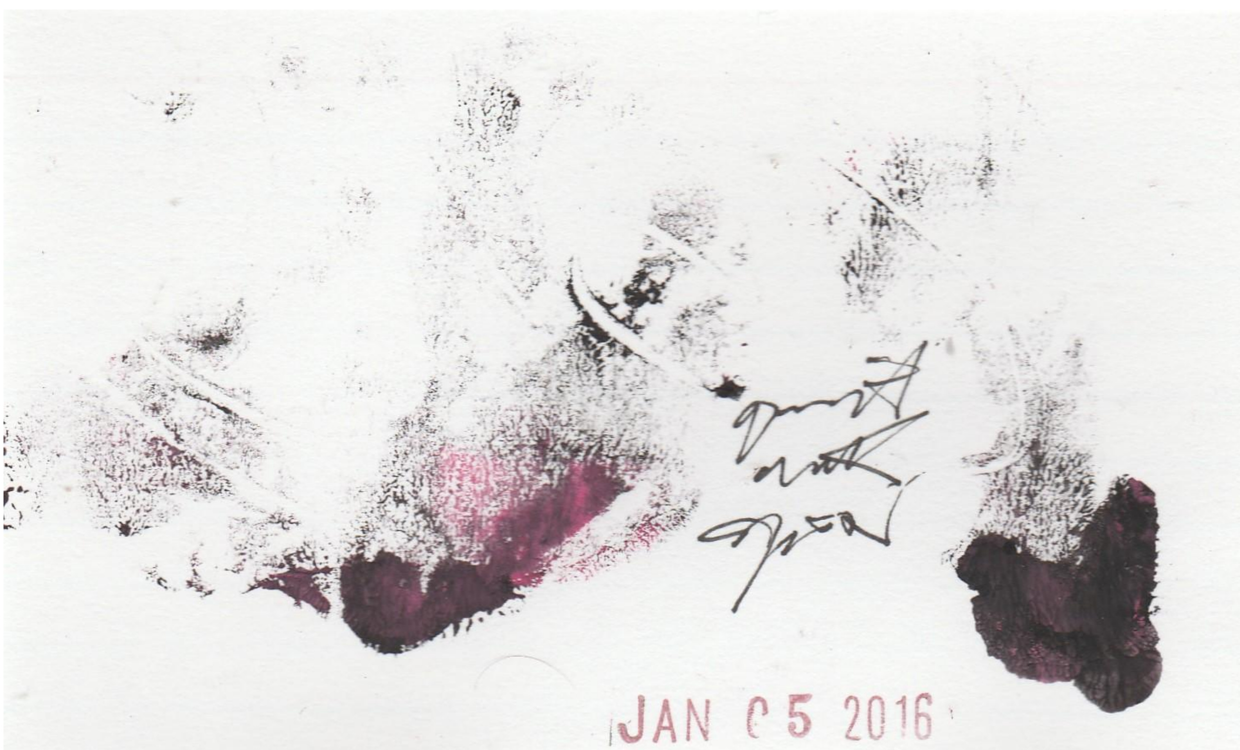
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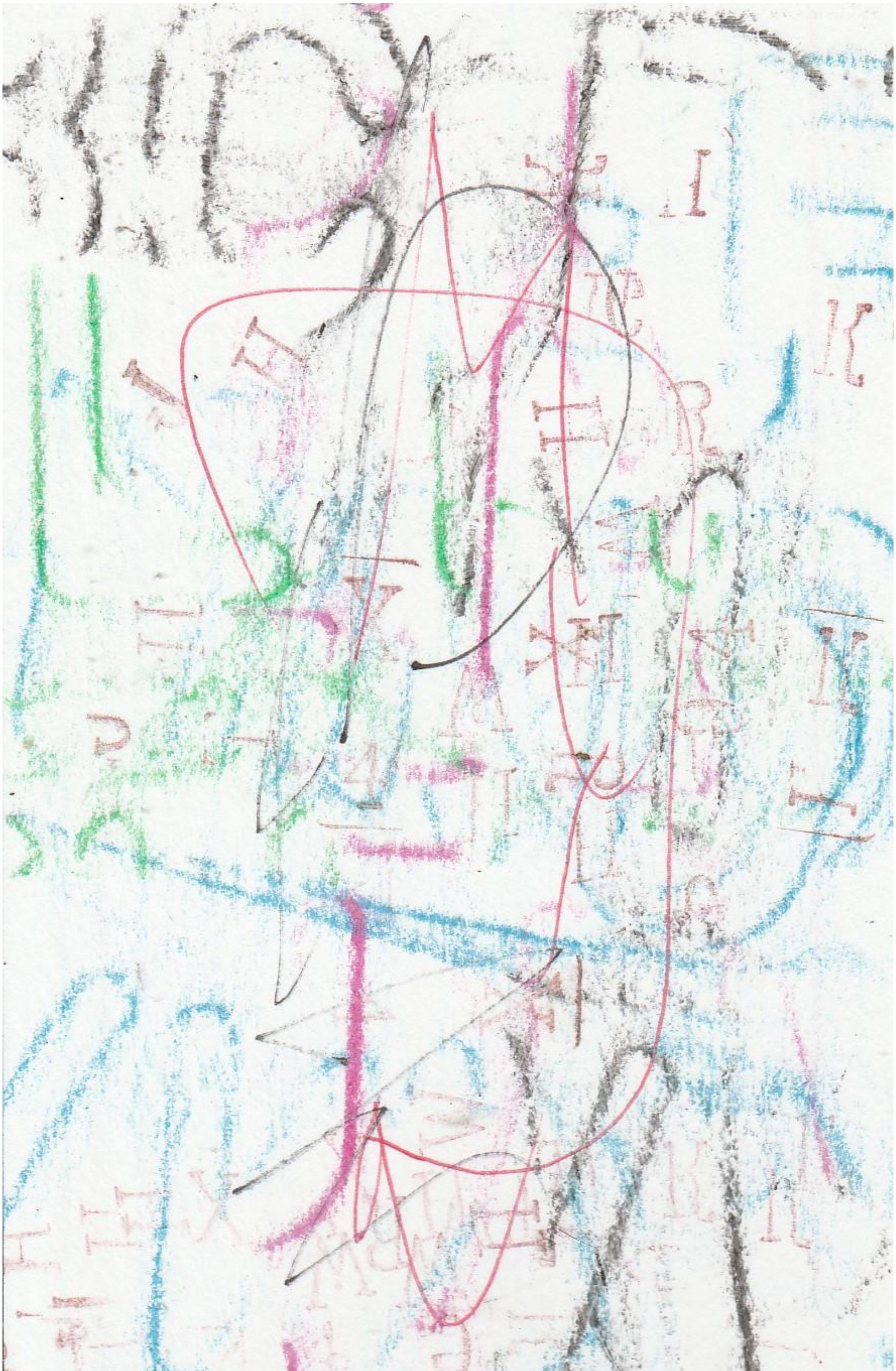

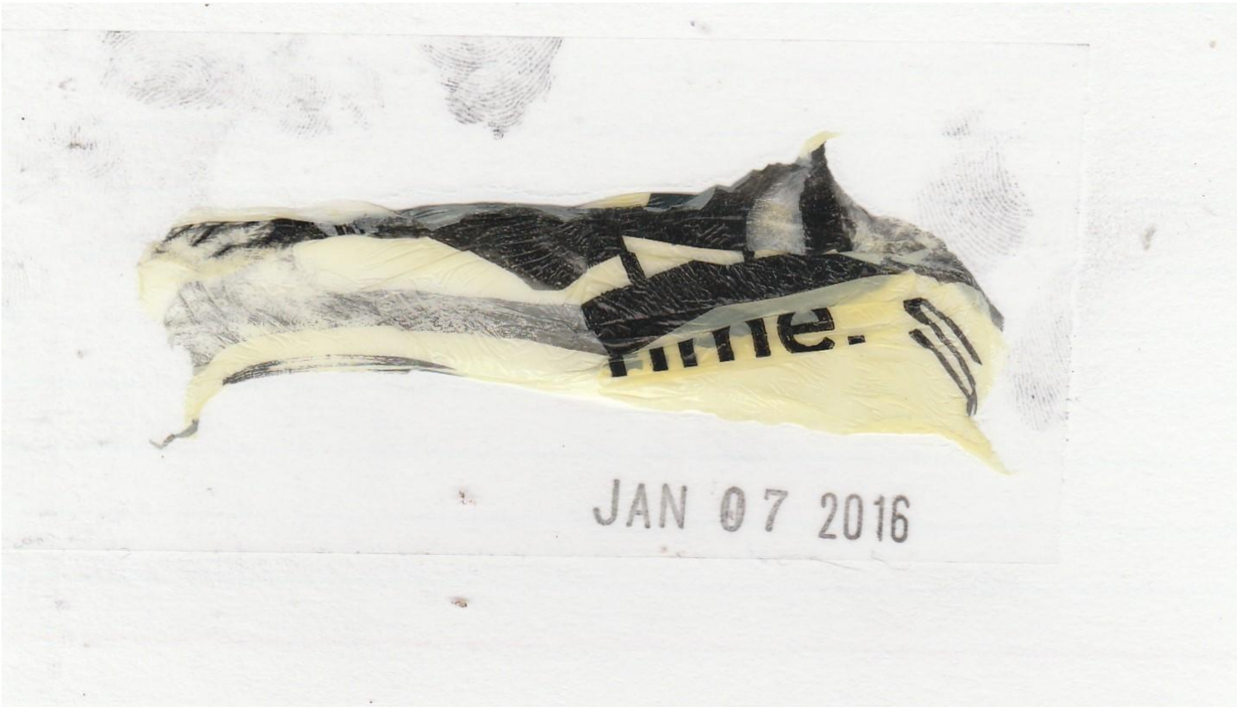
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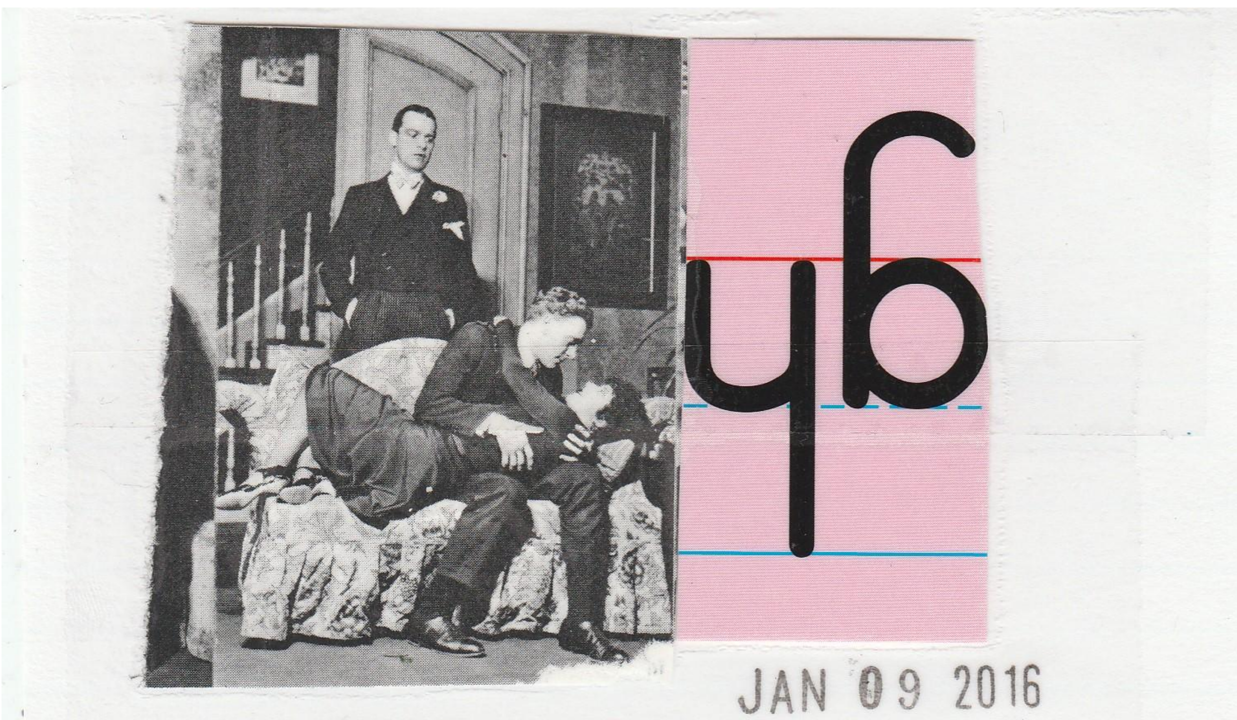
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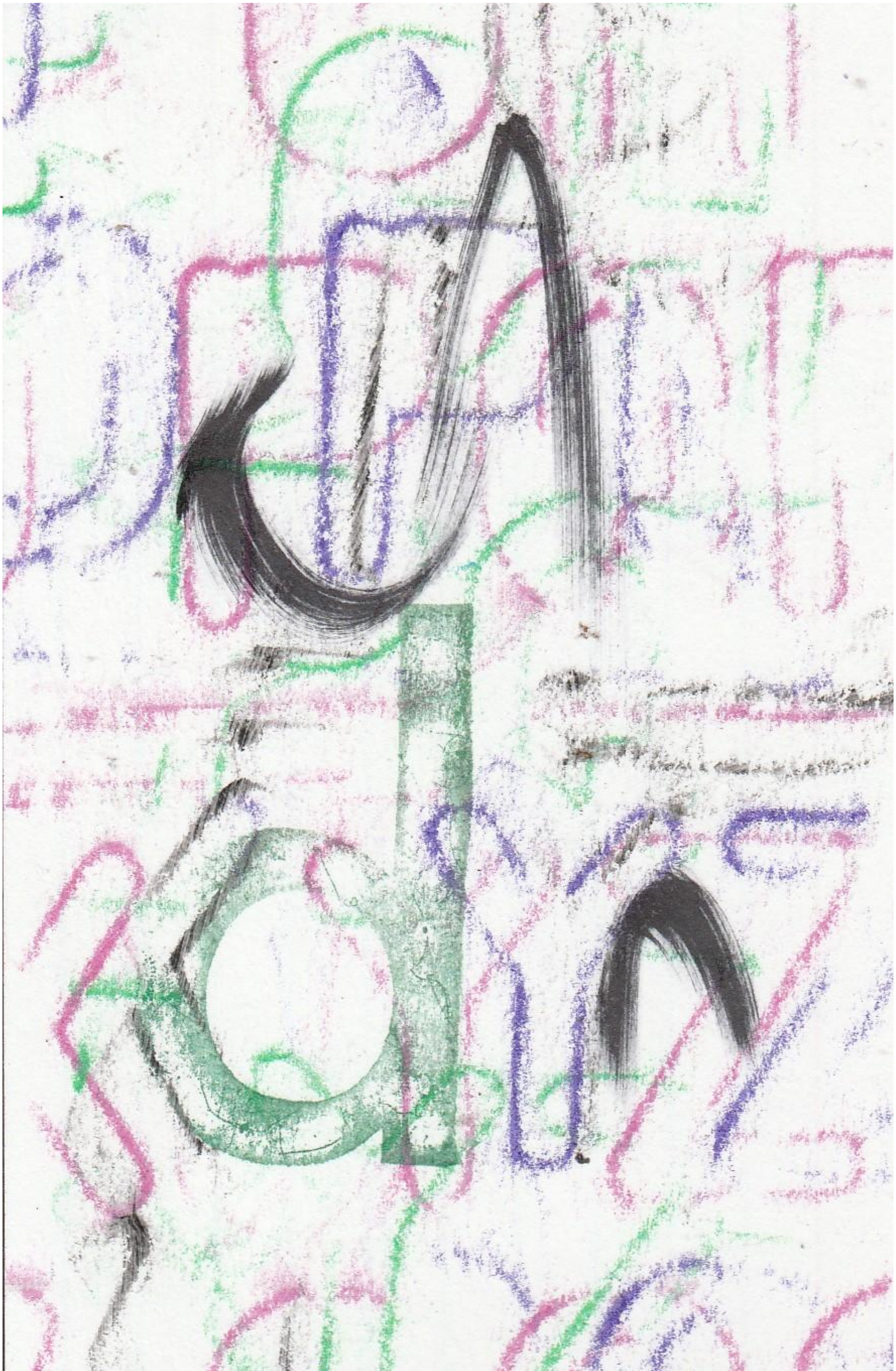

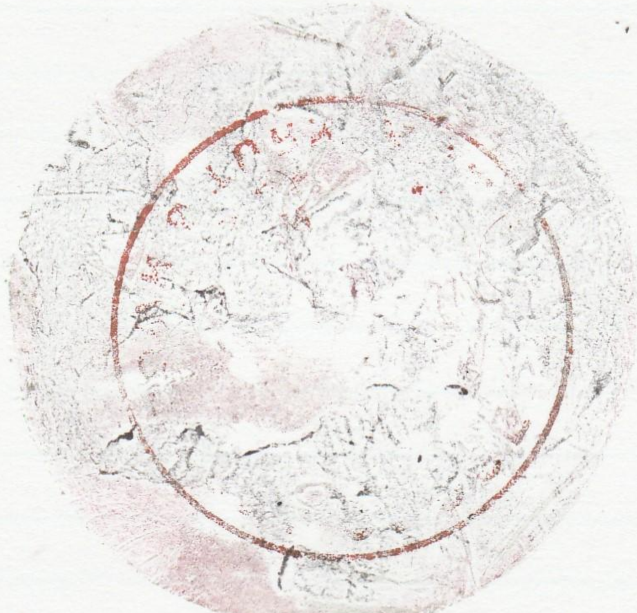

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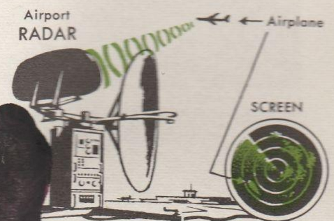
radar \'rā-ˌdär\ *n.*

ENGINEERING and PHYSI[illegible] electronic [illegible]hat sends radio waves and receives an[illegible]lyzes the [illegible]ted waves, or echoes. It is used to deter[illegible] the directi[illegible]d distance to, an object, and uses ra[illegible]engths in t[illegible] of 0.75 cm to 1.0 meter.

RADAR *is used by some u[illegible]ations to [illegible]oud masse[illegible]rricanes and other stor[illegible]ty.*



[illegible]ial s[illegible]metry \'rād-ē-əl 'si[illegible]\

[illegible] The form of an ani[illegible]n the sh[illegible] cylinder [illegible]th a central axis [illegible]hich si[illegible]dy parts are [illegible]as in jellyfish an[illegible] see *bi[illegible]ymmetry.*

An a[illegible] DIAL SYMMETR[illegible]*e cut in[illegible]dentical halves [illegible]ise cut in any [illegible] th[illegible]entral axis.*

SYMMETRY

radial velocity [illegible]

ASTRONOMY. The [illegible] which a star is appr[illegible]or going [illegible]

A spectroscope can b[illegible] to determine [illegible] *of some stars.*

radian \'rād-ē-ən\ *n.*

MATHEMATICS. A unit of angul[illegible]easure the radius of a circle. It is an [illegible] circle, intercepts an arc equa[illegible] therefore, is an arc of a cir[illegible] that circle.

B[illegible]se the circumferenc[illegible] 2 π [illegible]us equal 360 [illegible] RADIAN *equals* [illegible] *degrees.*

RADIAN

radiant energy \'rād-ē-ənt 'en-ə[illegible]

PHYSICS. Energy that travels as electrom[illegible] ing such energy as light, X rays and radio w[illegible]

All RADIANT ENERGY *travels at the speed of light.*

by Michael Faraday in the 1830s. Practical MHD and EGD devices have had a much shorter history, however. The first large experimental MHD generator was constructed in the U.S. in 1938 by B. Karlovitz and D. Halász. These experiments were unsuccessful, however, because neither the properties of ionized gases nor the need for very high gas temperatures were sufficiently understood. By 1959, technology had progressed sufficiently so that 10 kilowatts of electric power were generated with an MHD device. Extensive research and development continue [illegible] Germany, Great Britain, Japan, Poland, the So[illegible] and the U.S.

Early attempts to construct a practical high-vo[illegible] generator were reported in the U.S. in 1932, and in 1935. Large-scale work on EGD generation of el[illegible] from fossil fuel dates from the late 1960s, with d[illegible] ment work begun in the United States.

The magnetohydrodynamic interaction finds pr[illegible] application today in flowmeters, accelerators, pumps a[illegible] generators. Electromagnetic flowmeters, in use for se[illegible] decades, do not interfere with fluid flow and have no moving parts. They are used to measure liquid metal flow, [illegible] of arterial blood, and ocean currents.

Electromagnetic [illegible] pumps, easy to make corrosion-resistant, and with [illegible] are often used in ha[illegible] liquid metals. When used with gaseous working fluids, [illegible] devices are called MHD accelerators; space-flight propulsion systems based on the MHD interaction have been proposed.

MAGNETOHYDRODYNAMIC POWER GENERATION

The most important application for magnetohydrodynamics is power generation. In large public-utility plants that burn fossil fuel, significantly more efficient conversion of fuel to electricity and consequent [illegible] in fuel and reduction of [illegible] heat can be a[illegible] an open-cycle MHD ge[illegible] topping (desc[illegible]), conventional steam power plant.

In [illegible] operations, the working fluid (gas) is eventually exhausted to the atmosphere; in closed-cycle systems, the fluid is reused. Topping means that the gases generated by burning the fuel (coal, oil, gas) are first passed through an MHD generator and then on to a conventional steam generator.

Closed-cycle systems

Closed-cycle nuclear-fuelled MHD systems are possible. A gas, heated to a very high temperature by the nuclear reactor, may be passed first through an M[illegible] and then through the steam plant. After losi[illegible] heat) energy, the gas may be returned to t[illegible] for reheating.

Power-generating systems. In a[illegible] power-generating system, the work[illegible] hausted to the atmosphere must b[illegible] The only practical fluid is the ga[illegible] fuel combustion with air or oxyge[illegible] cle consists of a combustion cha[illegible] fuel burns with an oxidizer at [illegible] a high-temperature working fl[illegible] the combustion gases are acc[illegible] around 3,300 feet (1,000 me[illegible] duct in which electrical po[illegible] A diffuser is used to retar[illegible] atmosphere, and to raise [illegible]

Seeding fluid with potassium

The quantity of powe[illegible] amount of fluid depe[illegible] ductivity. At the highe[illegible] fuels (about 5,430° [illegible] C), electrical conductivity of the combustion [illegible] low to obtain adequate power yield. Cons[illegible] is seeded with a material such as po[illegible] easily and raises power yields to accep[illegible]

As the gas expands in the [illegible] and power is extracted, the gas cools and its electrical conductivity falls rapidly. At about 3,630° F (2,000° C), the MHD power-generation process ceases to be economically attractive, and the simple open-cycle system thus has a low efficiency. Since the exhausted gas is still hot in comparison with normal power-plant working fluids, the efficiency of the simple open-cycle system can be substantially increased by recovering the energy remaining in the gas stream with conventional methods.

Open cycle with heat recovery. Heat energy recovered from the MHD duct exhaust gas is used in two ways. First, it heats the high-pressure air fed to the combustion chamber. Second, the remaining heat is used to produce steam in a conventional boiler and power is generated in the conventional way.

The hea[illegible]; when the [illegible] condenses on [illegible] collected. Once [illegible] precipitator [illegible] culate matter [illegible] kestack. About [illegible] ering the heat-[illegible] cal power. The [illegible] m plant (45 to [illegible] han that of the [illegible] percent).

[illegible] the closed-cycle [illegible] working fluid, at high pressure [illegible] reactor before it enters the MHD [illegible] working fluid is recycled, its [illegible] primary concern, and the gas can be chosen for [illegible] transfer and electrical properties. Helium is the [illegible] attractive gas, and cesium though expensive is the [illegible] easily ionized seed material. This system may be practical for bulk power generation because it offers a potential means of obtaining greater efficiencies from advanced-fission reactors. The top gas temperatures required are lower than peak open-cycle temperatures because certain processes can be used to increase electrical conductivity. A heat-recovery plant is still employed, however, because the conductivity of the fluid is too low for the process to be attractive at temperatures that are high by conventional steam-plant standards.

Closed-cycle liquid-metal systems are also being developed. These are a compromise between the higher thermal efficiency of gas-cycle MHD systems and the advantage of higher conductivity obtained by using liquid metal as the working fluid. Liquid metals have [illegible] electrical conductivity than seeded gases at all te[illegible]; power yields per given quantity of fluid can be [illegible] times higher than in MHD devices using ionized g[illegible]).

Many liquid-metal cycles have been proposed [illegible] space power and central power-station application[illegible] these, the liquid metal is heated in a nu[illegible] of the flow is vapourized, and the vapour [illegible] to a high velocity in a nozzle; the vapour mixes with and accelerates the liquid flow; when the vapour and liquid are separated, the liquid enters the MHD generator where part of its kinetic energy is converted to electricity. Liquid-metal systems are less efficient than gas systems.

MHD generator geometries. For liquid-metal MHD systems, the linear duct with a single electrode on each side as shown in Figure 46 is adequate. In gaseous systems designed for bulk power generation, however, a more complicated electrode geometry is required because of the Hall effect (named after its discoverer, U.S. physicist E.H. [illegible] which the motion of the electrons that carry the [illegible] to the magnetic field, produces an ad[illegible] along the duct axis. The additional [illegible] causes axial currents that seriously [illegible] electrical efficiency of the generator. To prevent thi[illegible] is divided into segments, each of which is conn[illegible] separate loads (Figure 48A). The result is a Faraday [illegible] (In Figure [illegible] through 48E, the [illegible] represented by I and the magnetic field by B.)

The Hall effect

When the Hall effect is [illegible] the transverse currents may be short [illegible] ar duct and the axial current used to [illegible] single load (Figure 48B); this is [illegible] advantage of the Hall generator with its [illegible] higher efficiency of the Faraday generator [illegible] by diagonally cross-connecting electrodes [illegible] 8C).

Other duct designs or geometries have been proposed to counteract the Hall effect. One is the disk generator (Figure 48D), in which the gas flows radially outward be-

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jim leftwich
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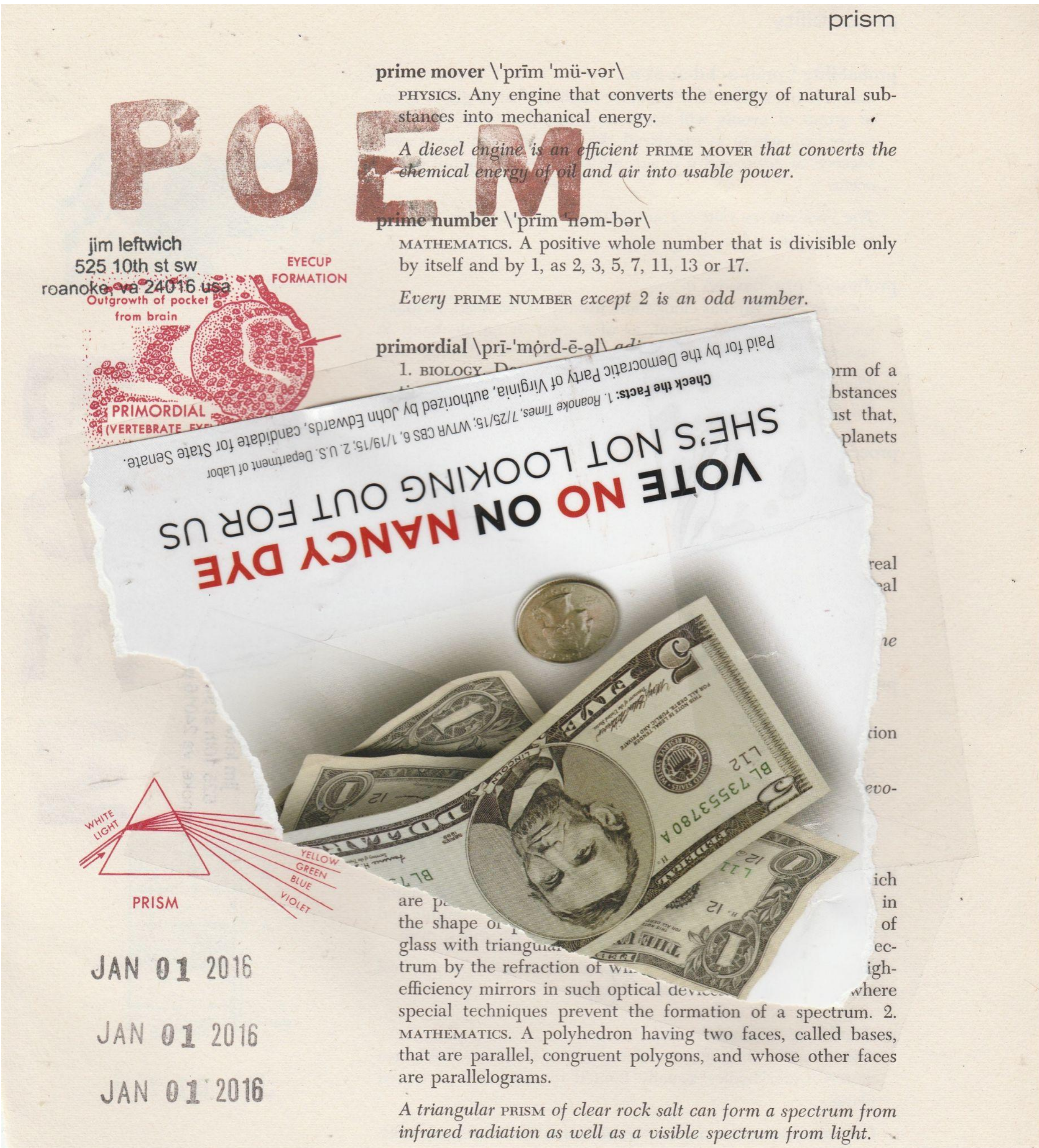
prism
prime mover \'prīm 'mü-vər\
PHYSICS. Any engine that converts the energy of natural substances into mechanical energy.
A diesel engine is an efficient PRIME MOVER that converts the chemical energy of oil and air into usable power.
POEM
prime number \'prīm 'nəm-bər\
MATHEMATICS. A positive whole number that is divisible only by itself and by 1, as 2, 3, 5, 7, 11, 13 or 17.
Every PRIME NUMBER except 2 is an odd number.
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EYECUP FORMATION
Outgrowth of pocket from brain
PRIMORDIAL (VERTEBRATE EYE)
primordial \prī-'mo̦rd-ē-əl\
Paid for by the Democratic Party of Virginia, authorized by John Edwards, candidate for State Senate.
Check the Facts: 1. Roanoke Times, 7/25/15; WTVR CBS 6, 1/19/15; 2. U.S. Department of Labor
SHE'S NOT LOOKING OUT FOR US
VOTE NO ON NANCY DYE
WHITE LIGHT
YELLOW
GREEN
BLUE
VIOLET
PRISM
special techniques prevent the formation of a spectrum. 2. MATHEMATICS. A polyhedron having two faces, called bases, that are parallel, congruent polygons, and whose other faces are parallelograms.
A triangular PRISM of clear rock salt can form a spectrum from infrared radiation as well as a visible spectrum from light.
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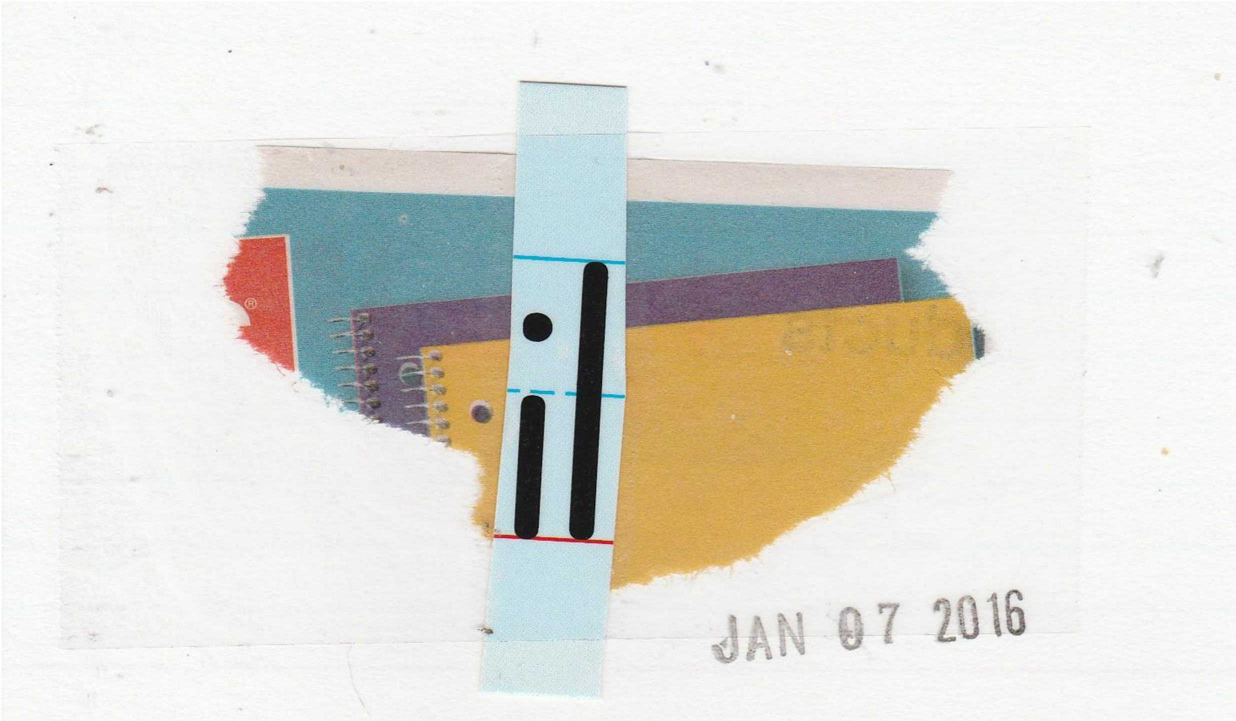
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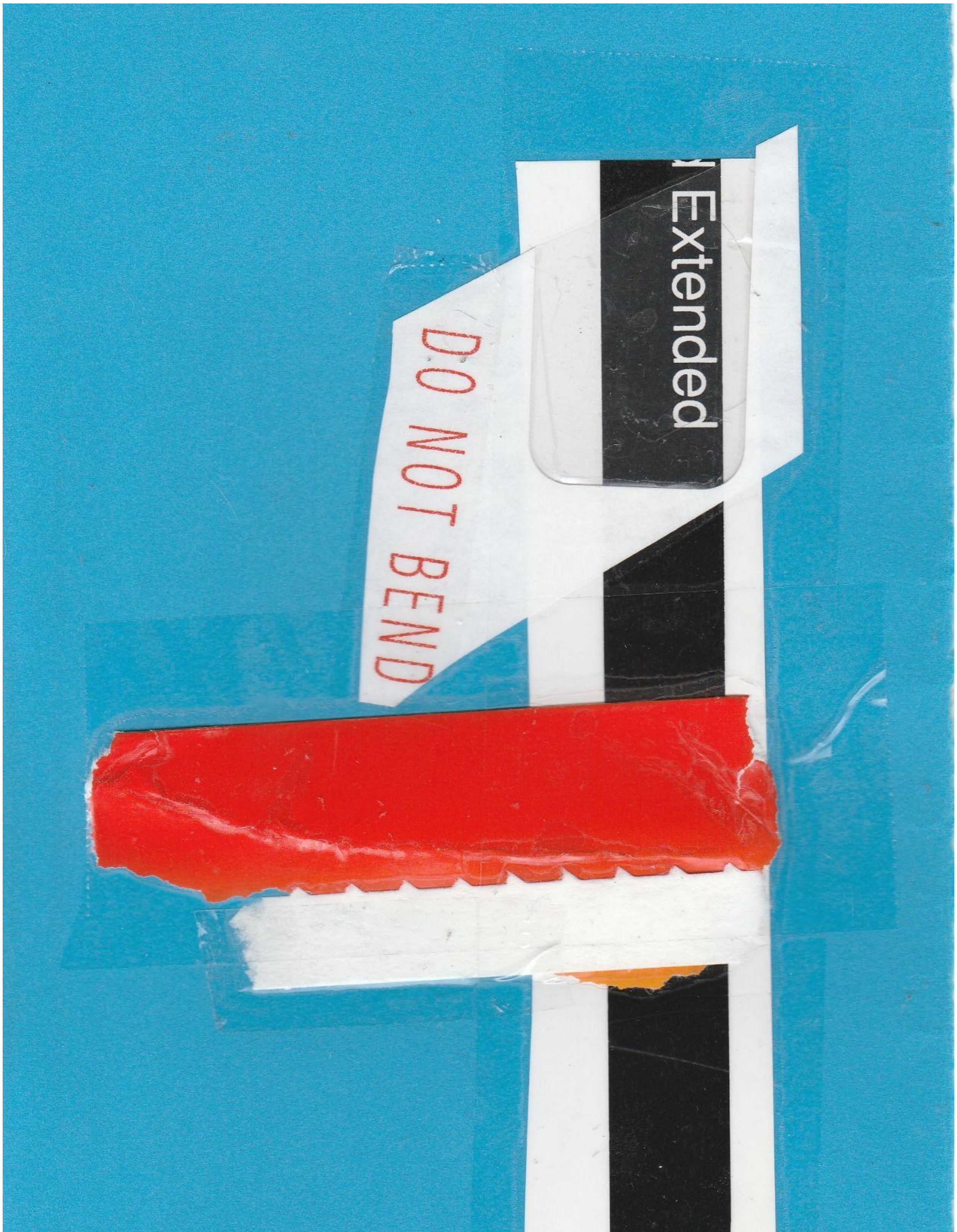

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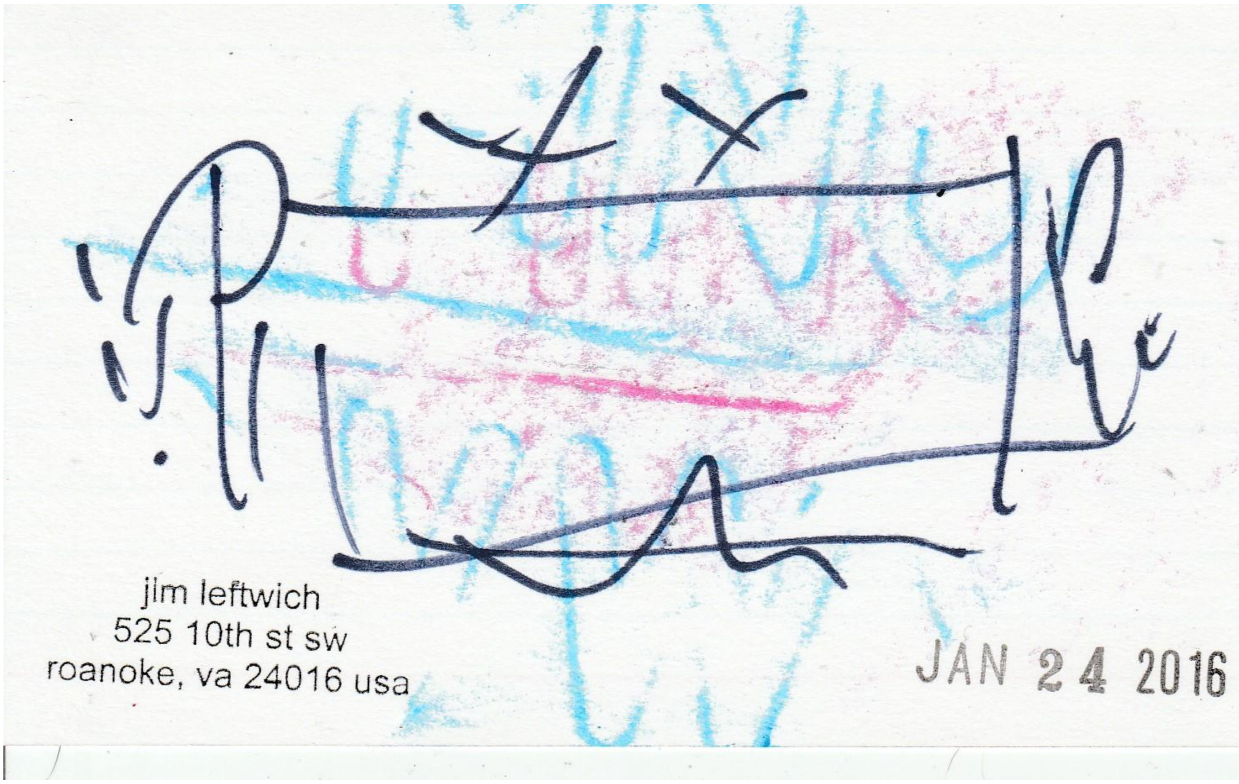
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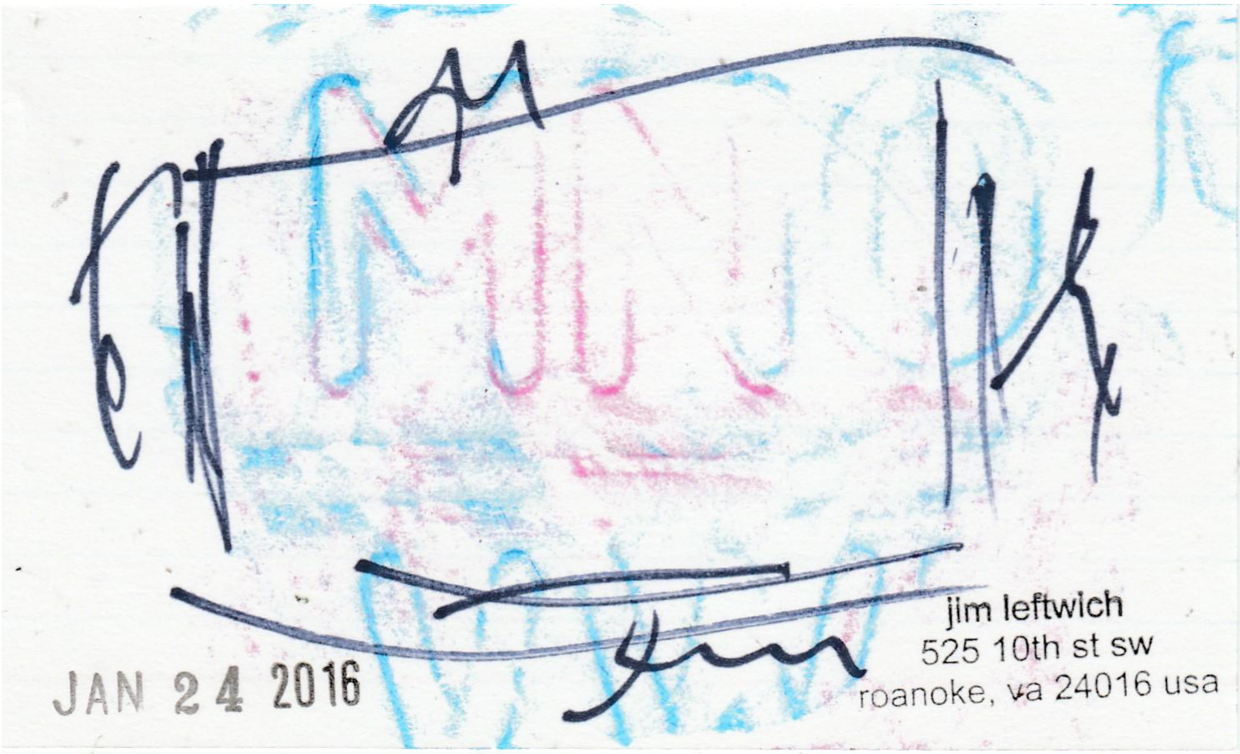
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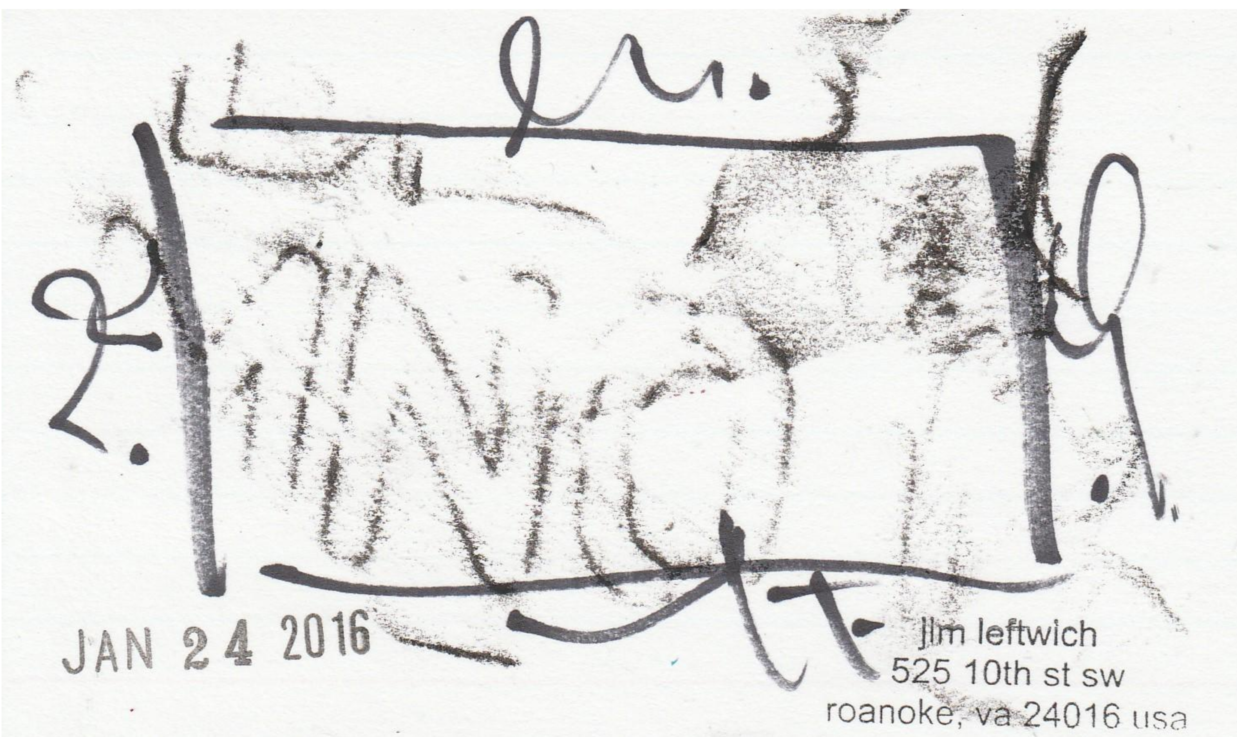
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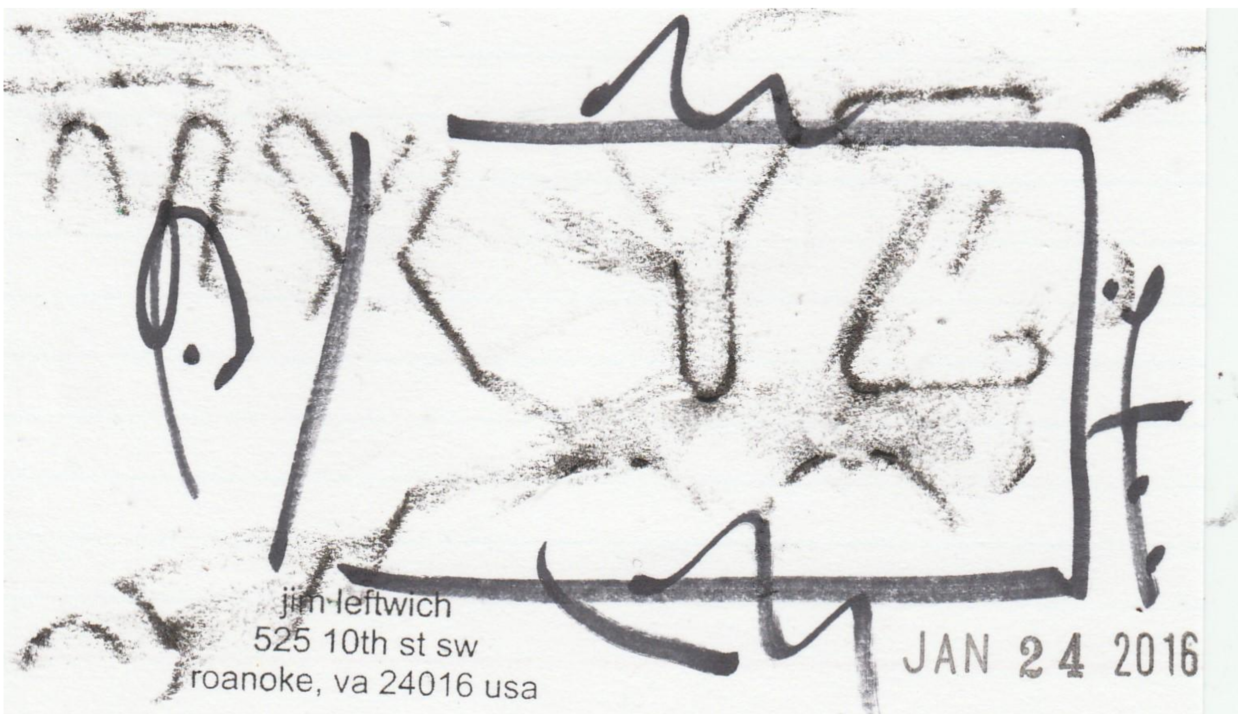
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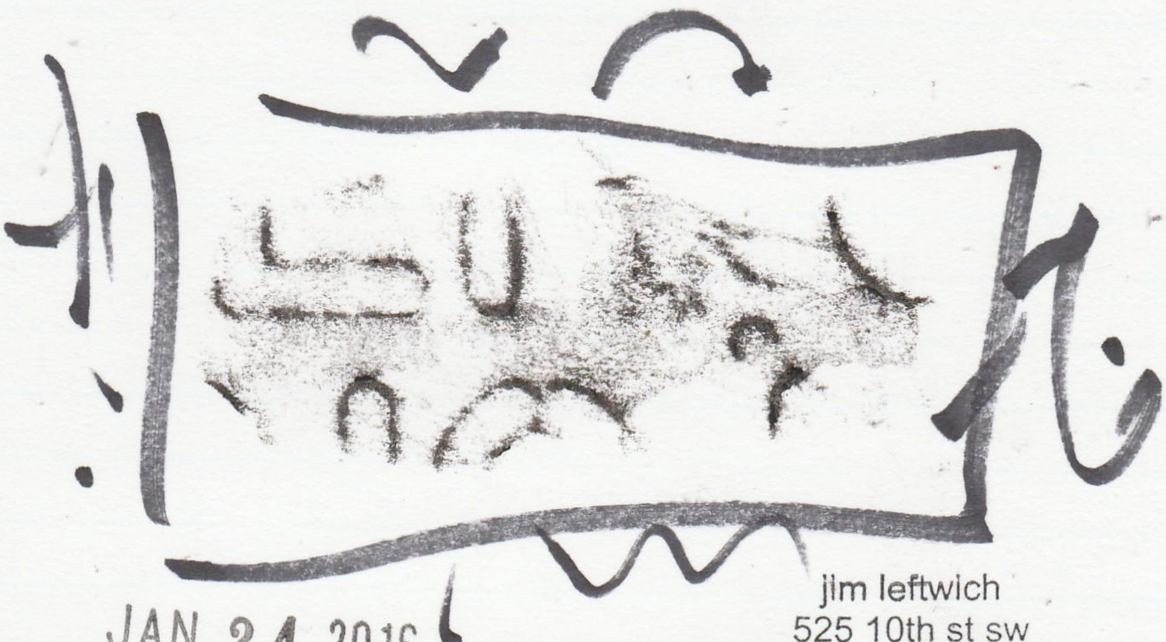

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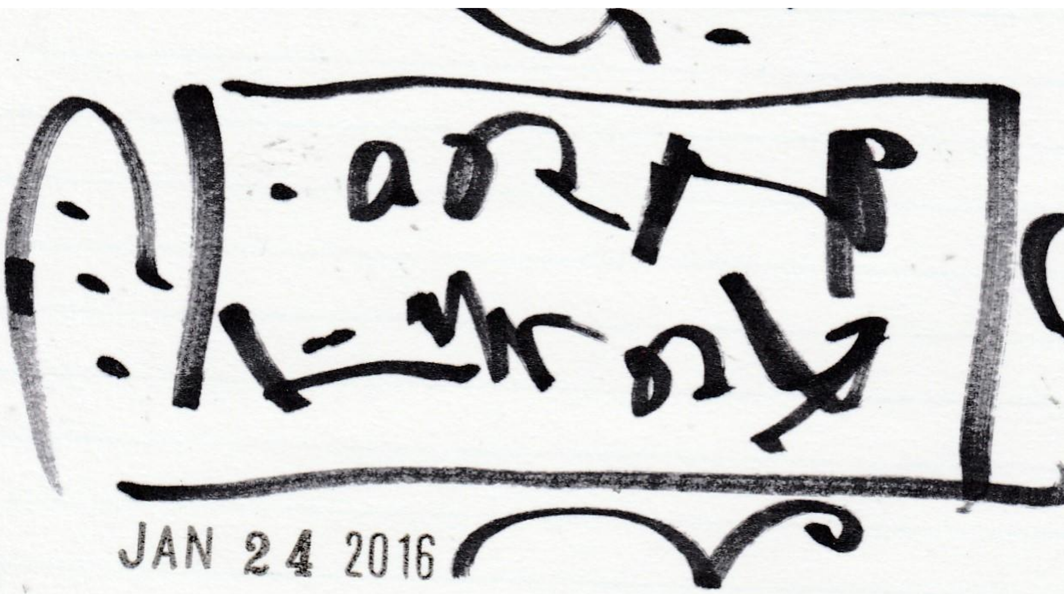

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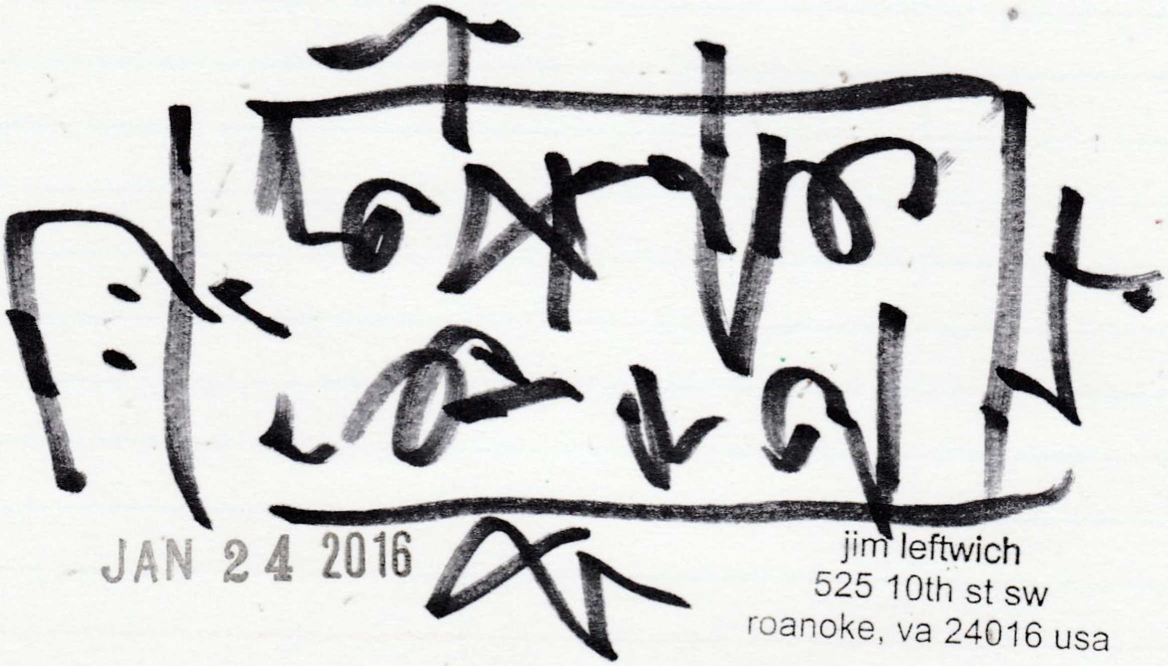

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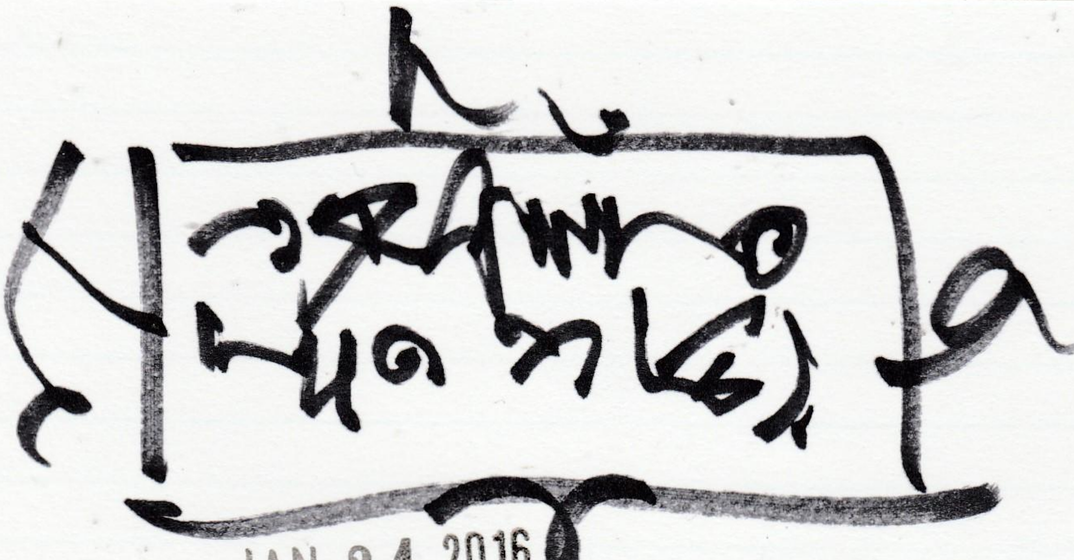

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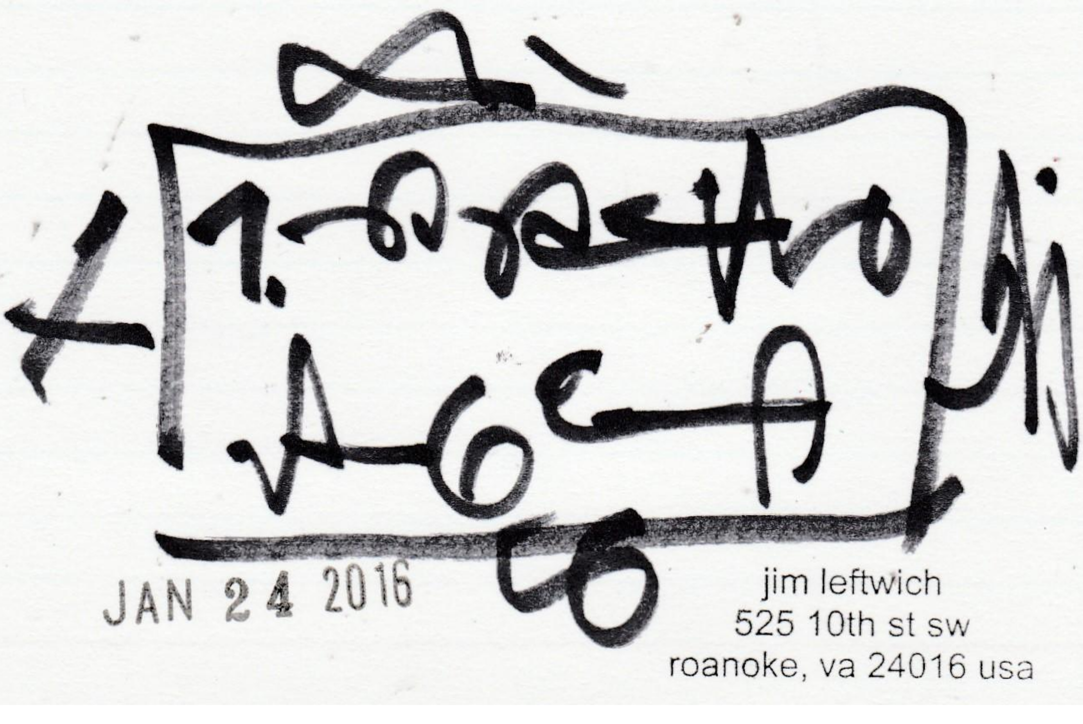

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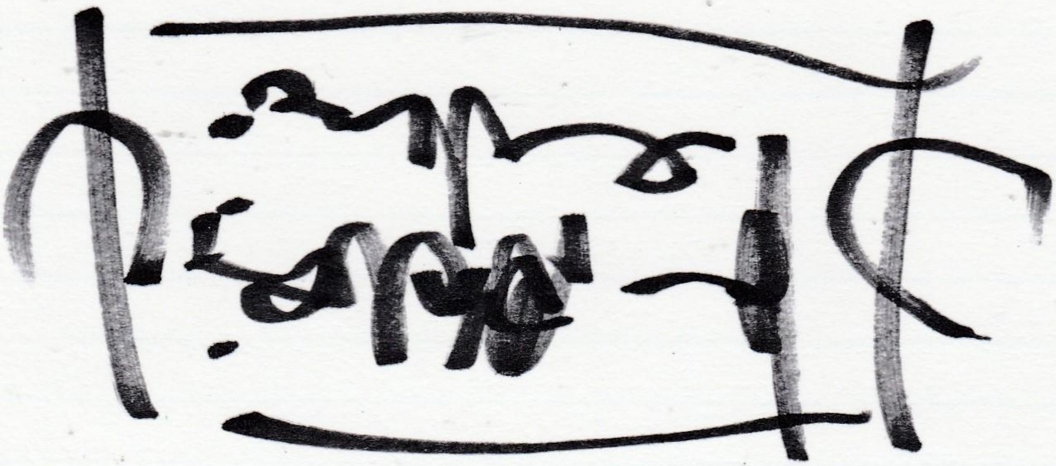

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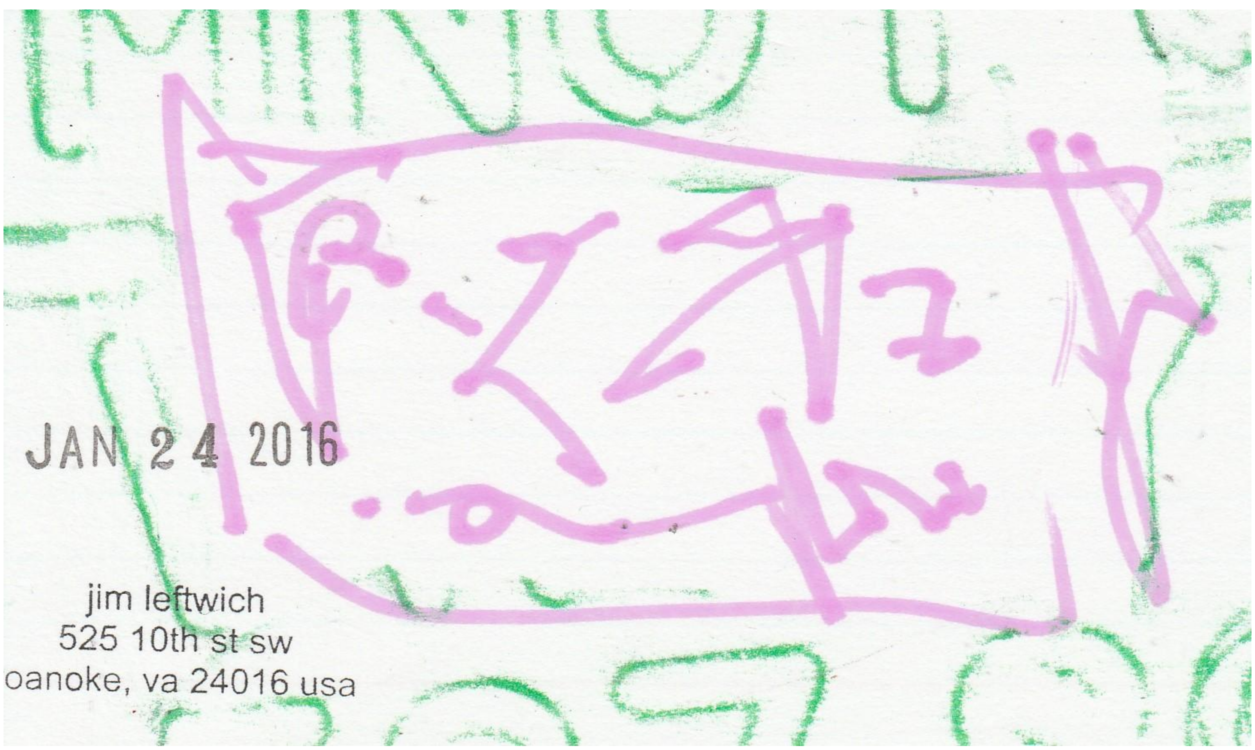

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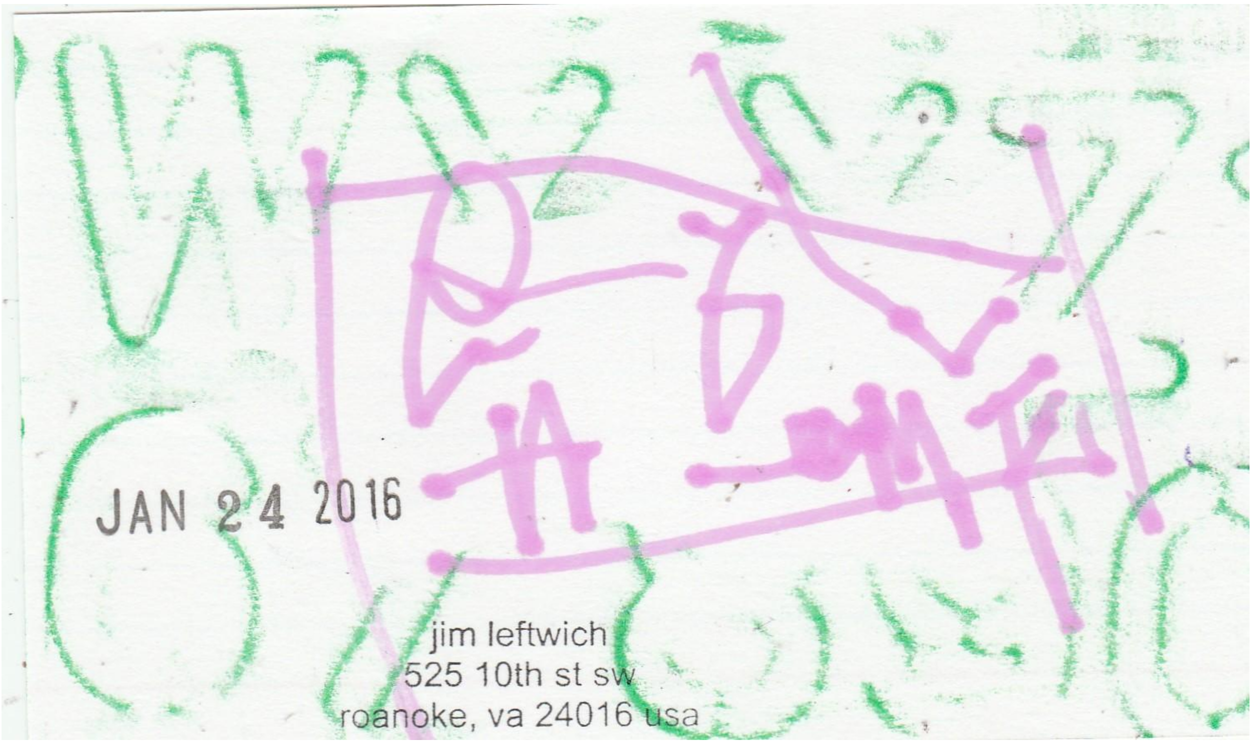
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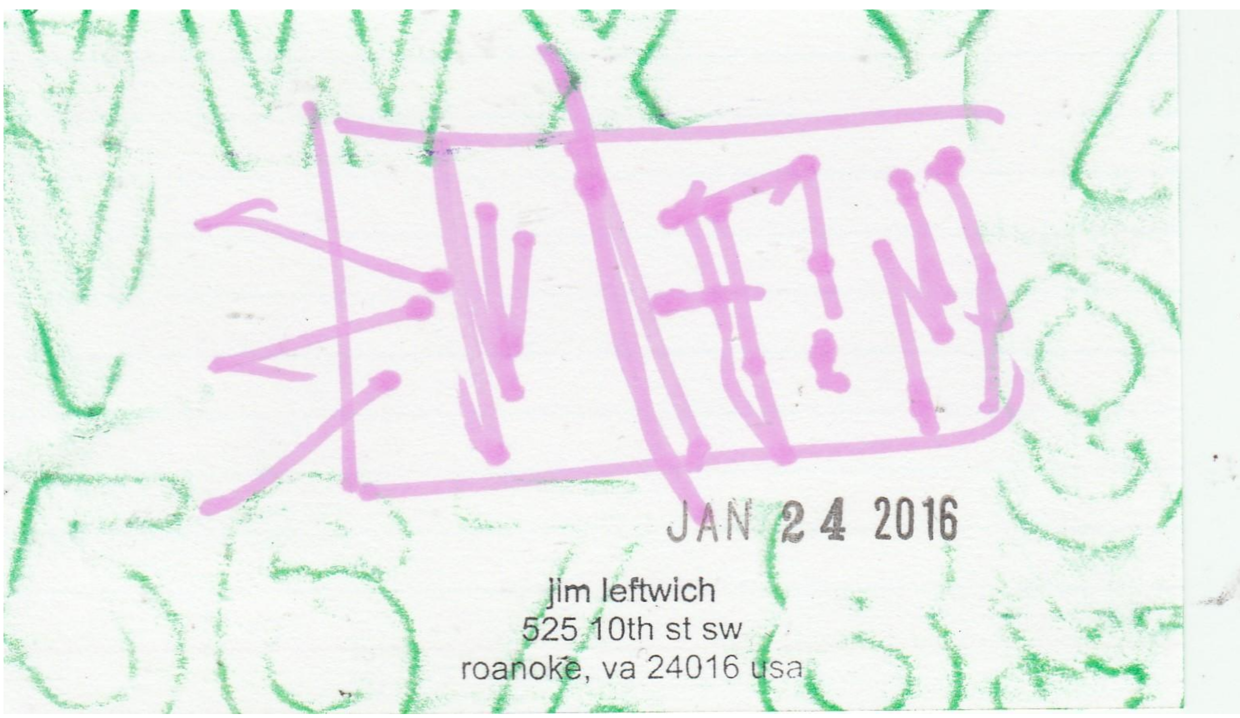
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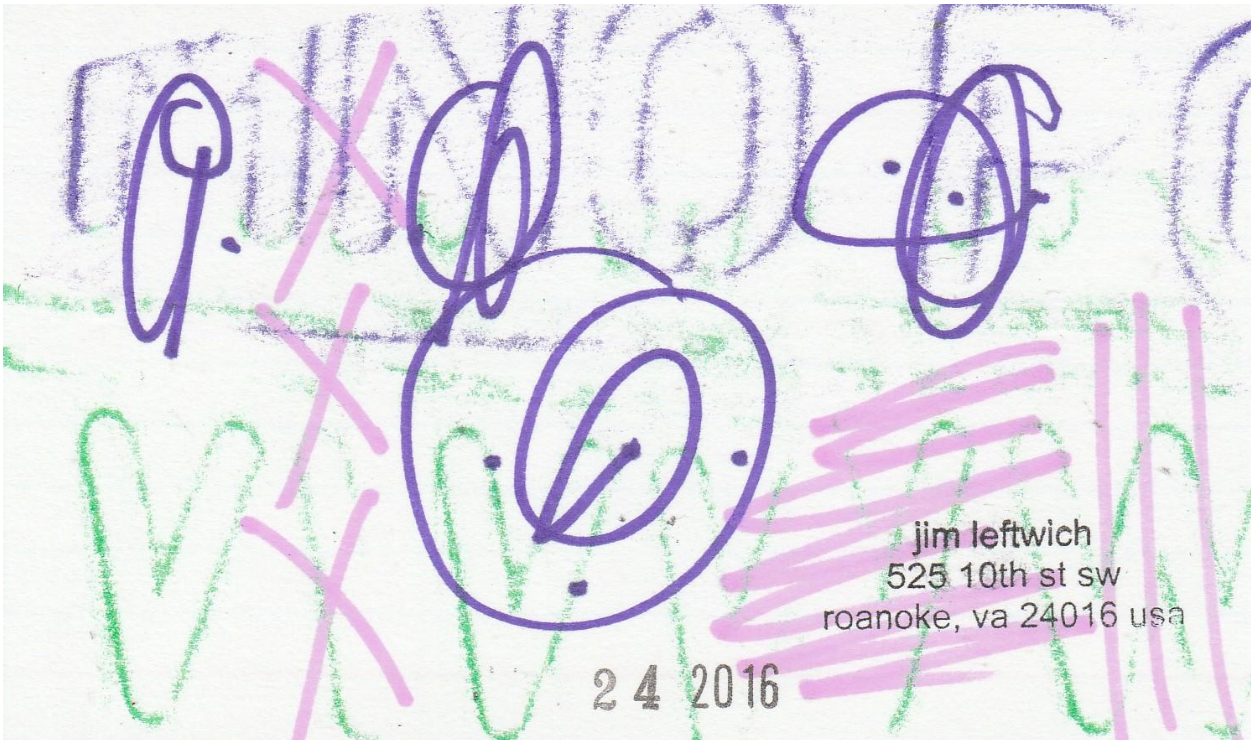
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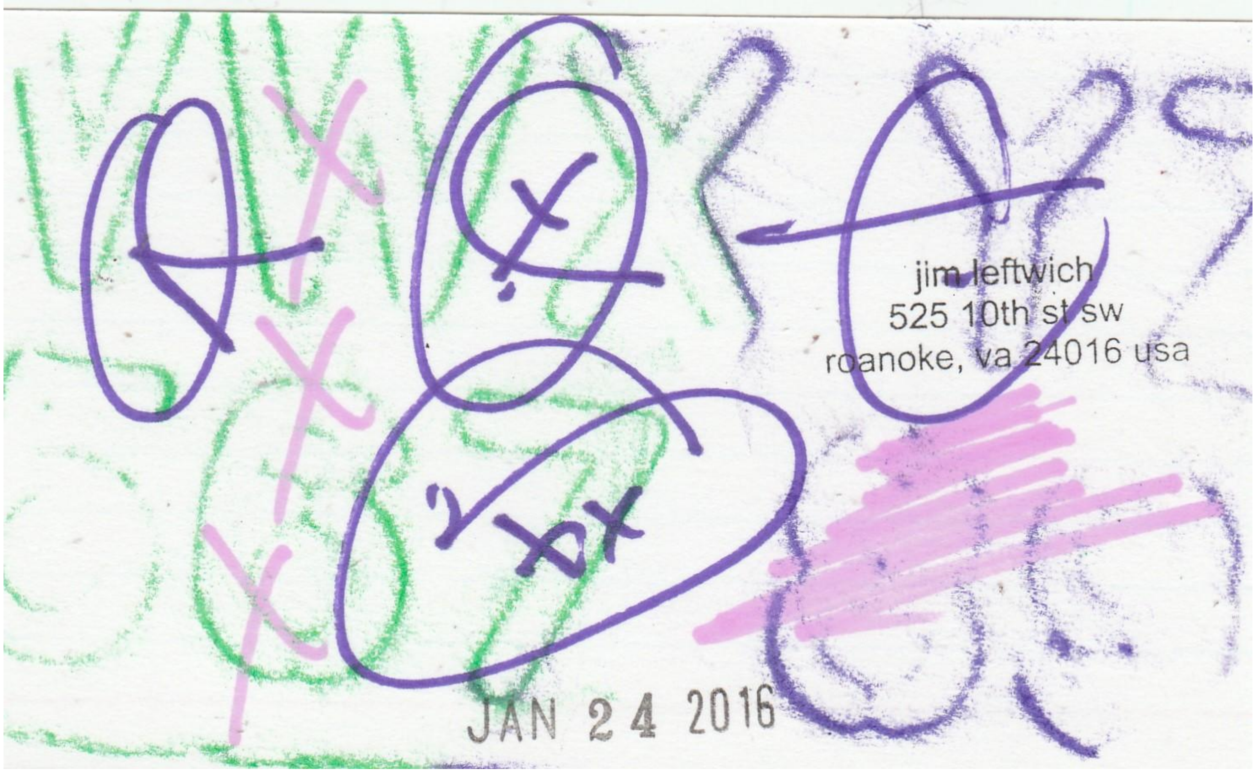
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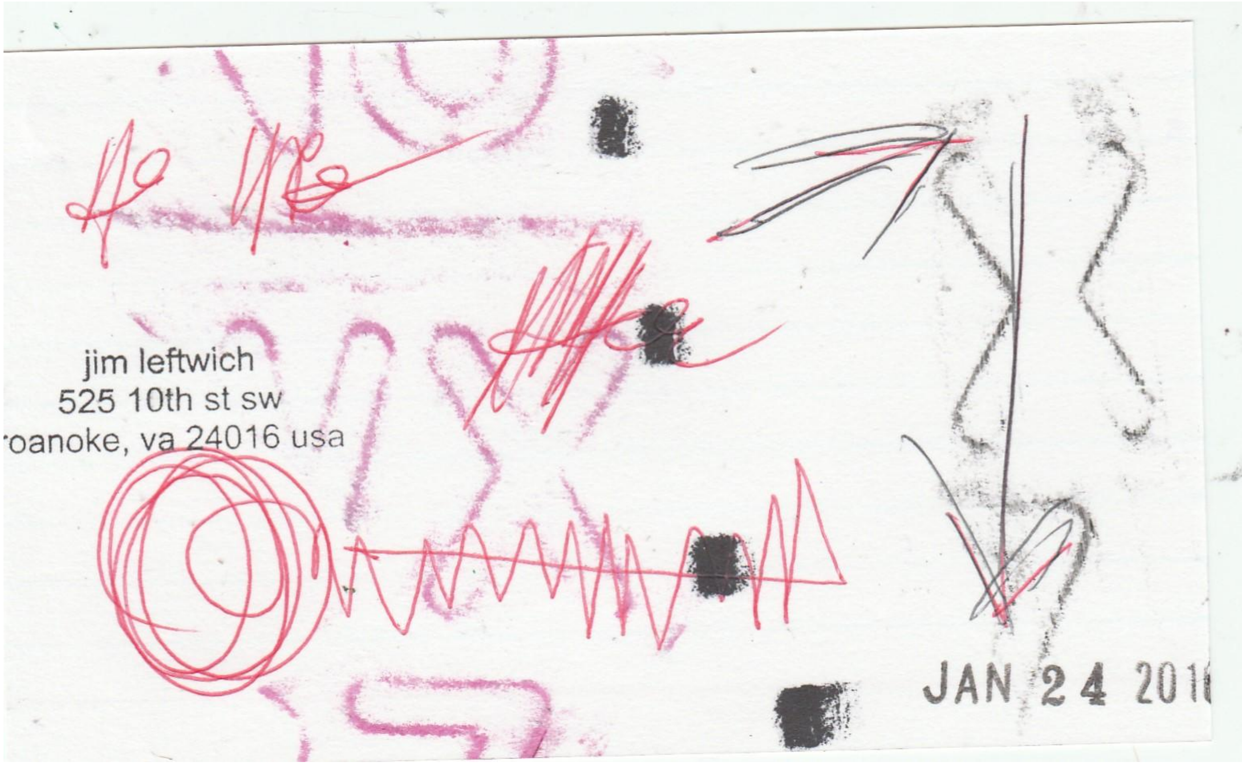
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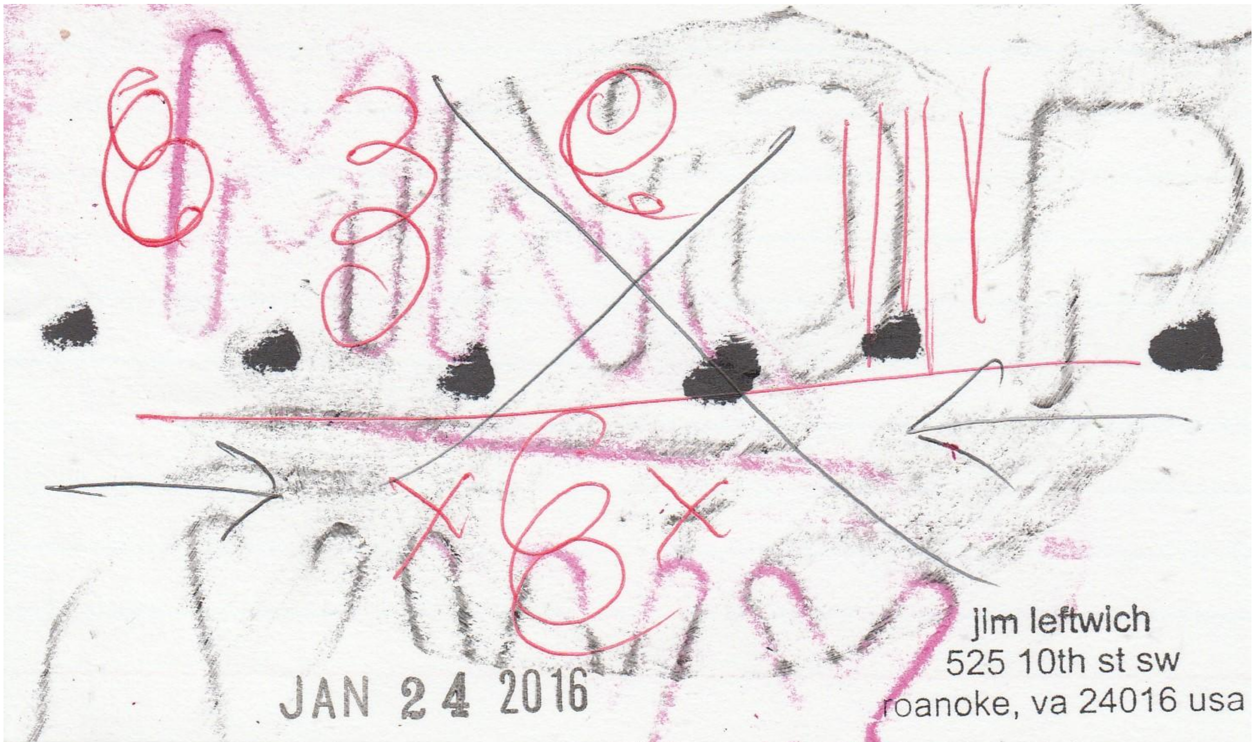
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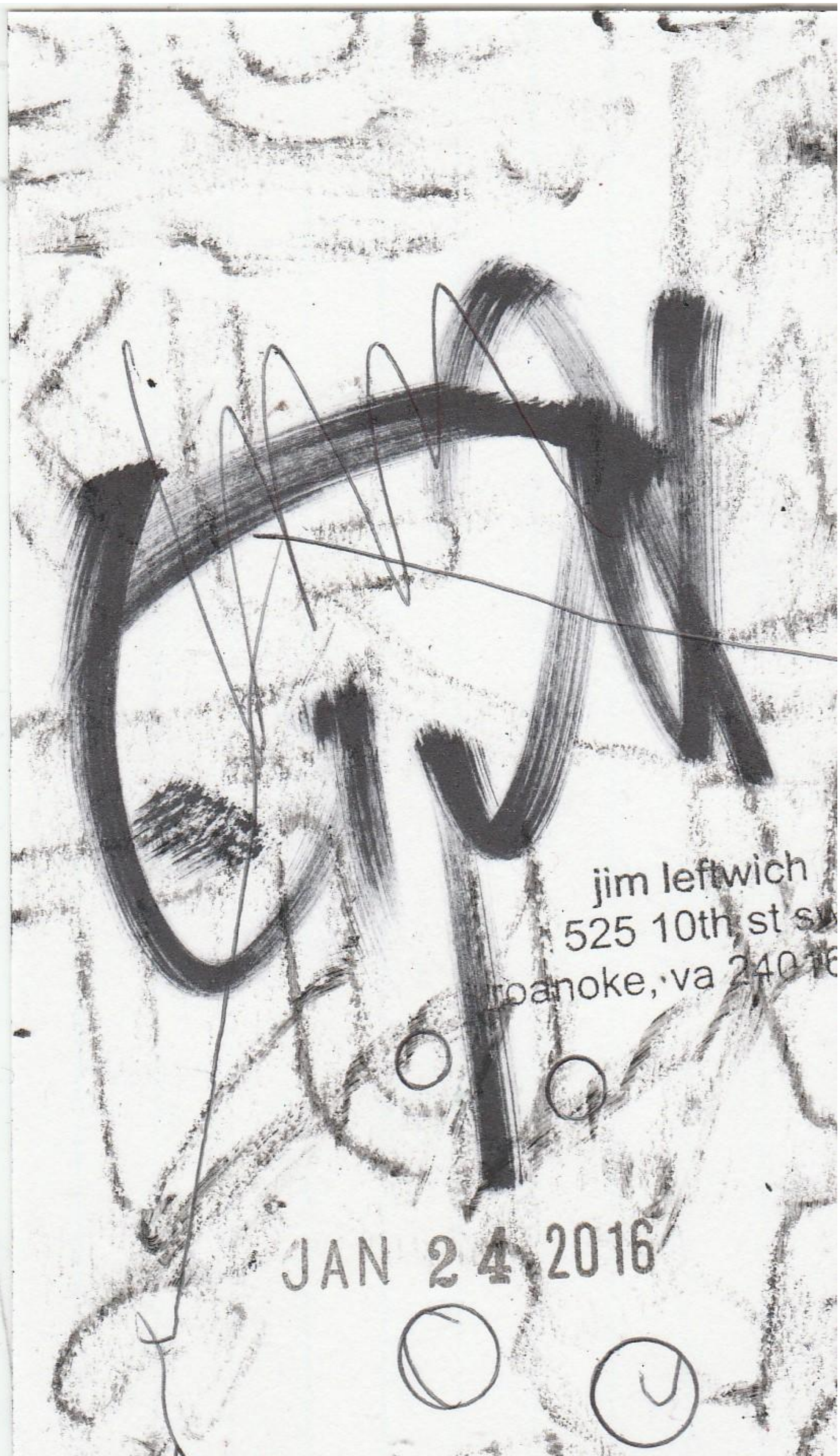
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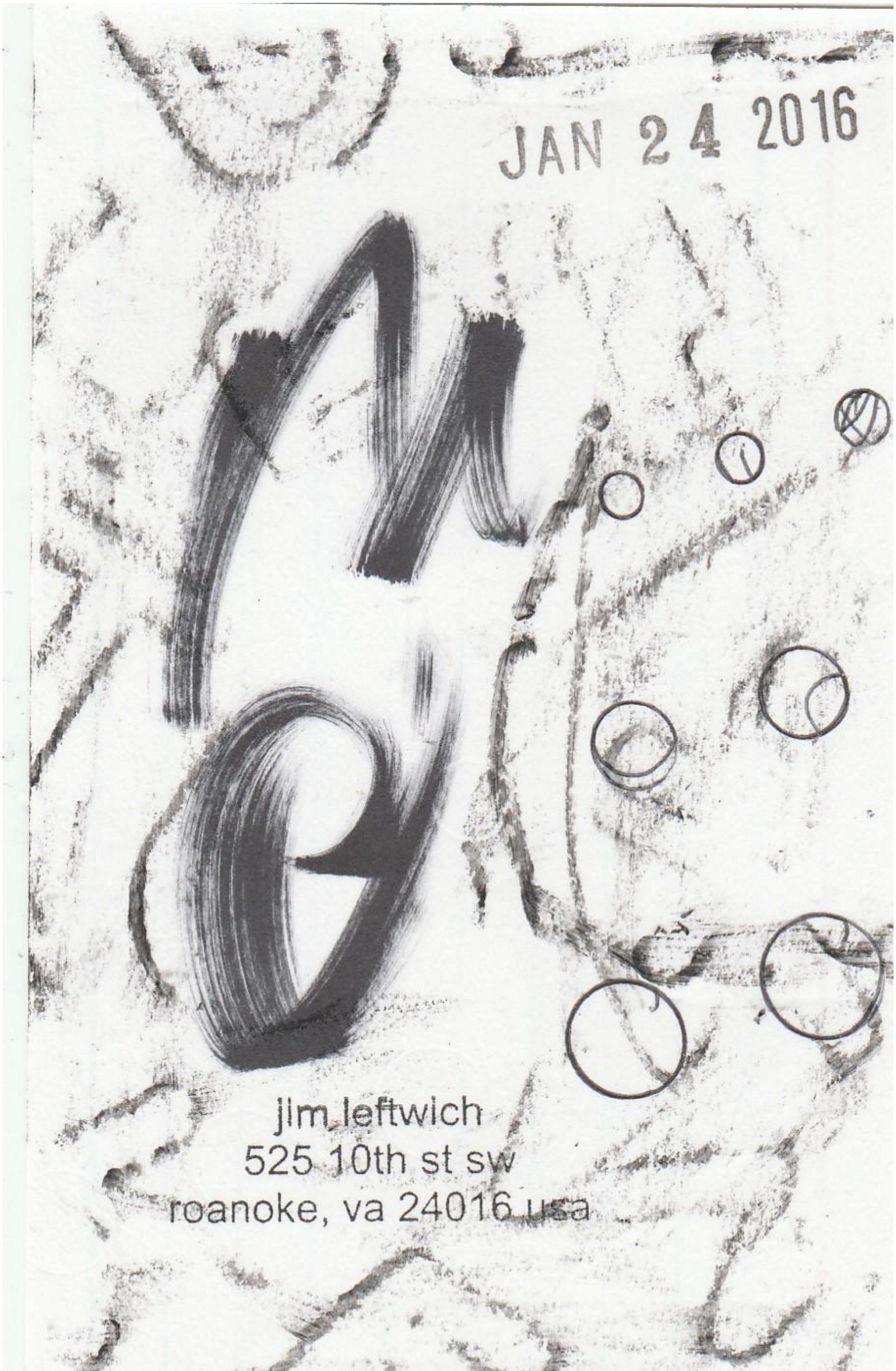
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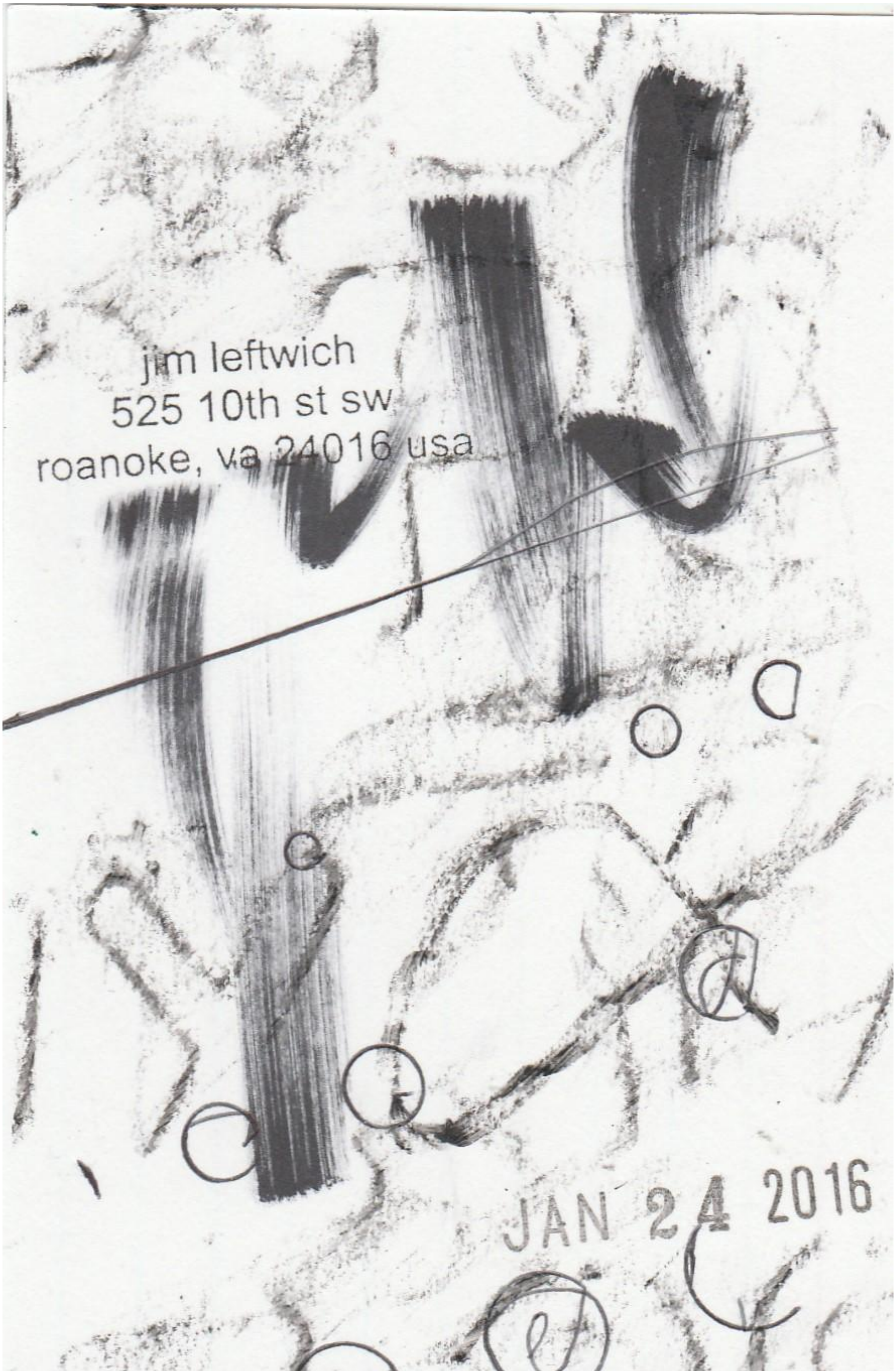
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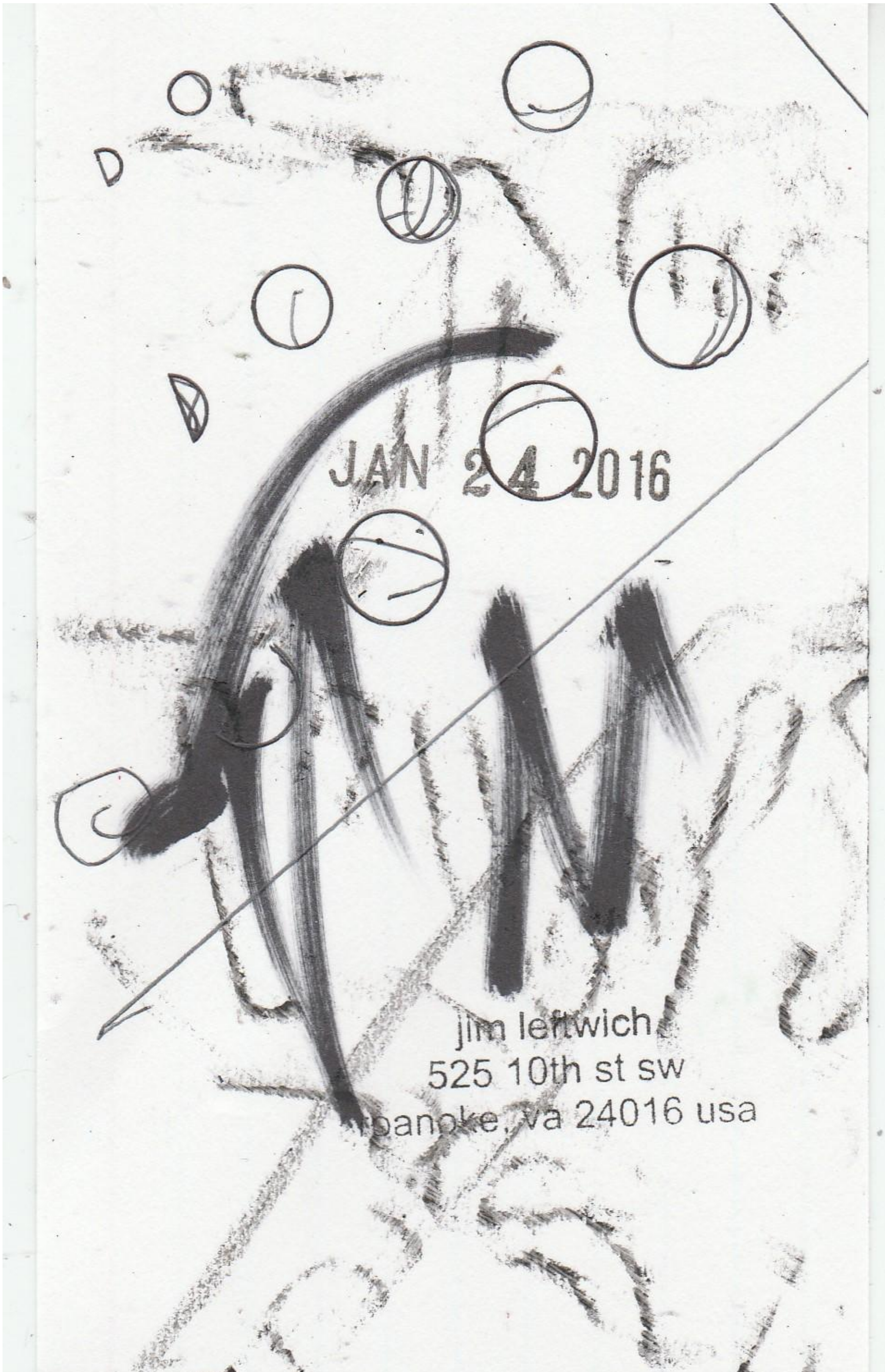
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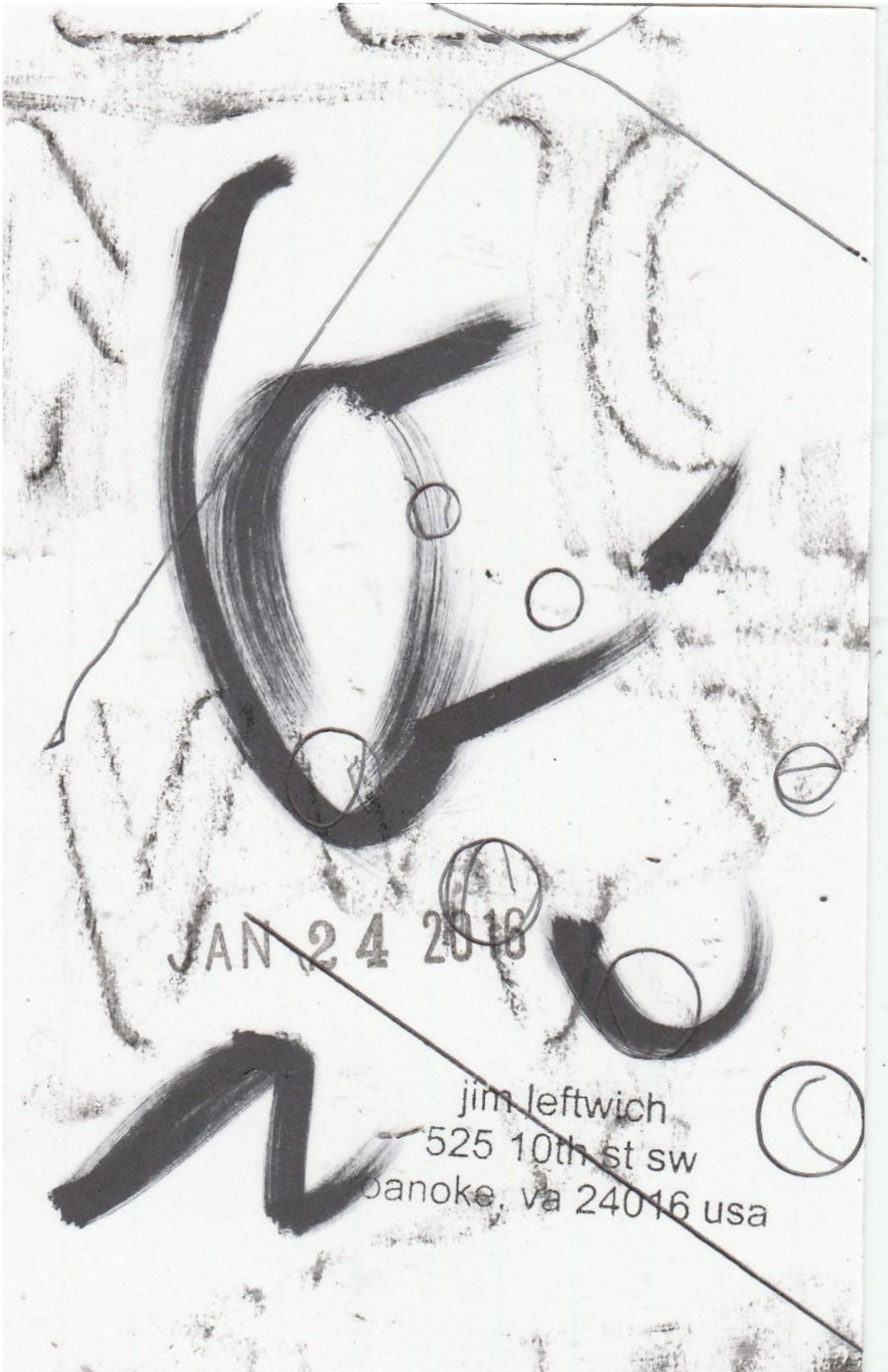
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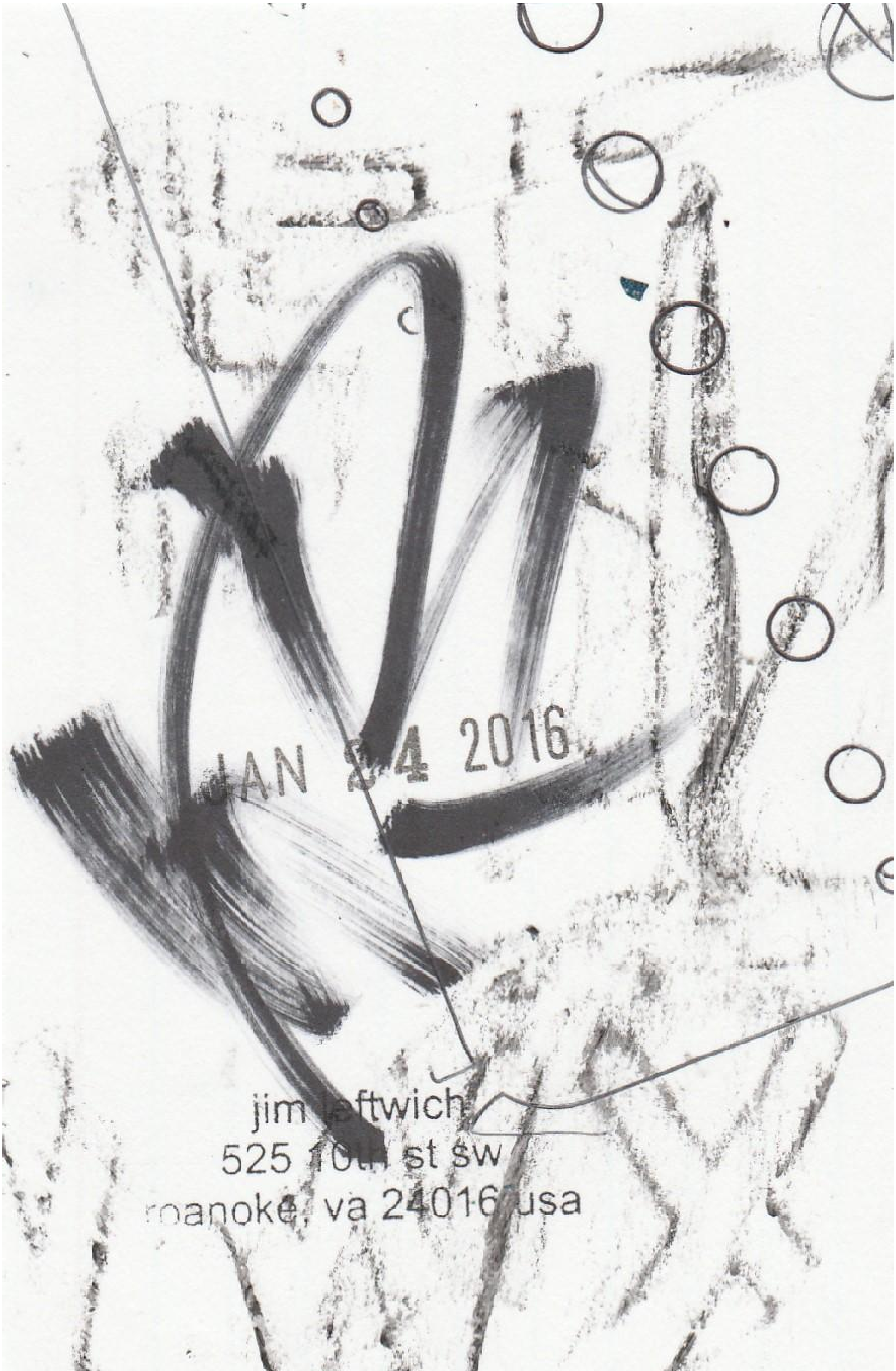
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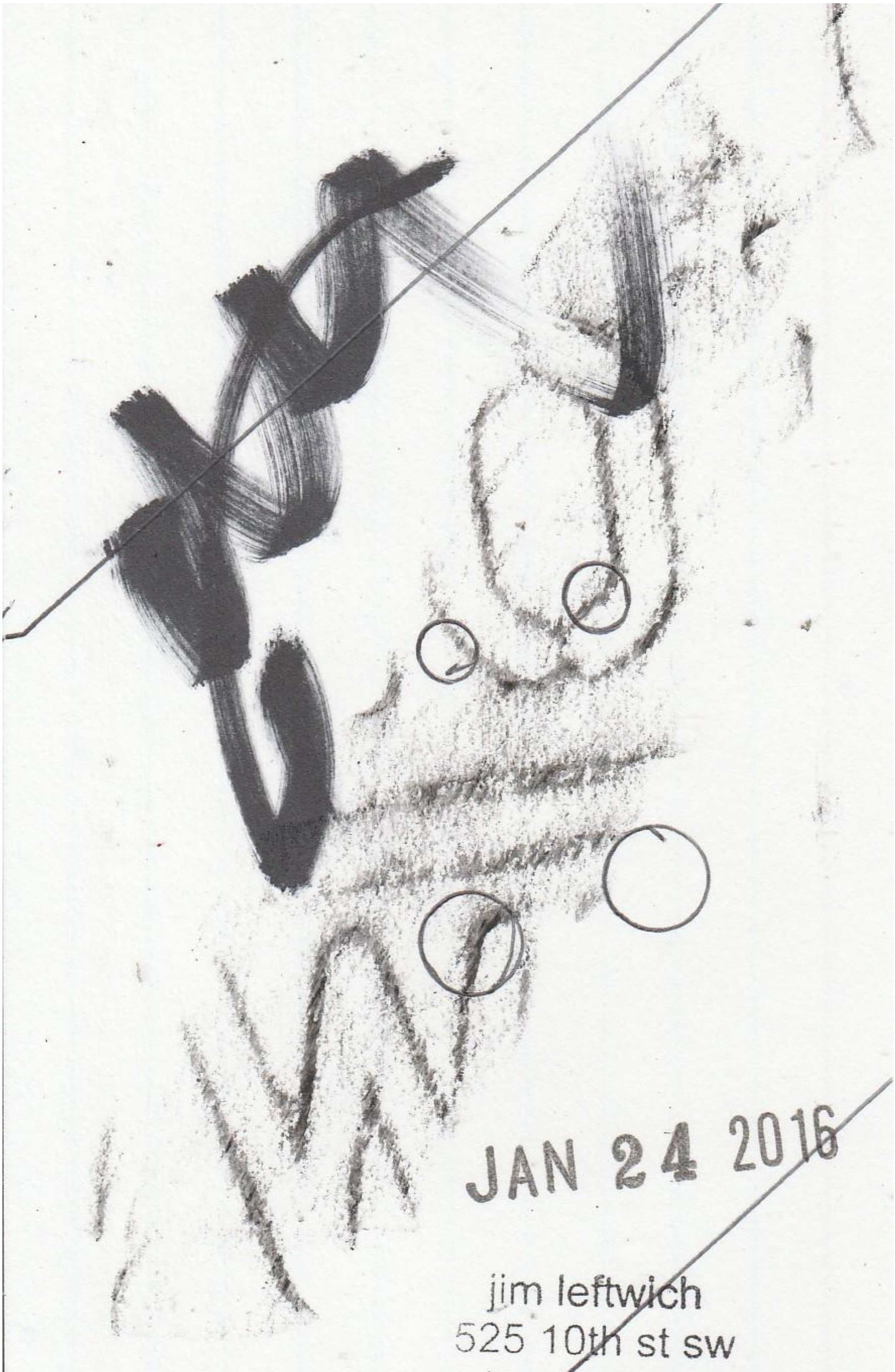
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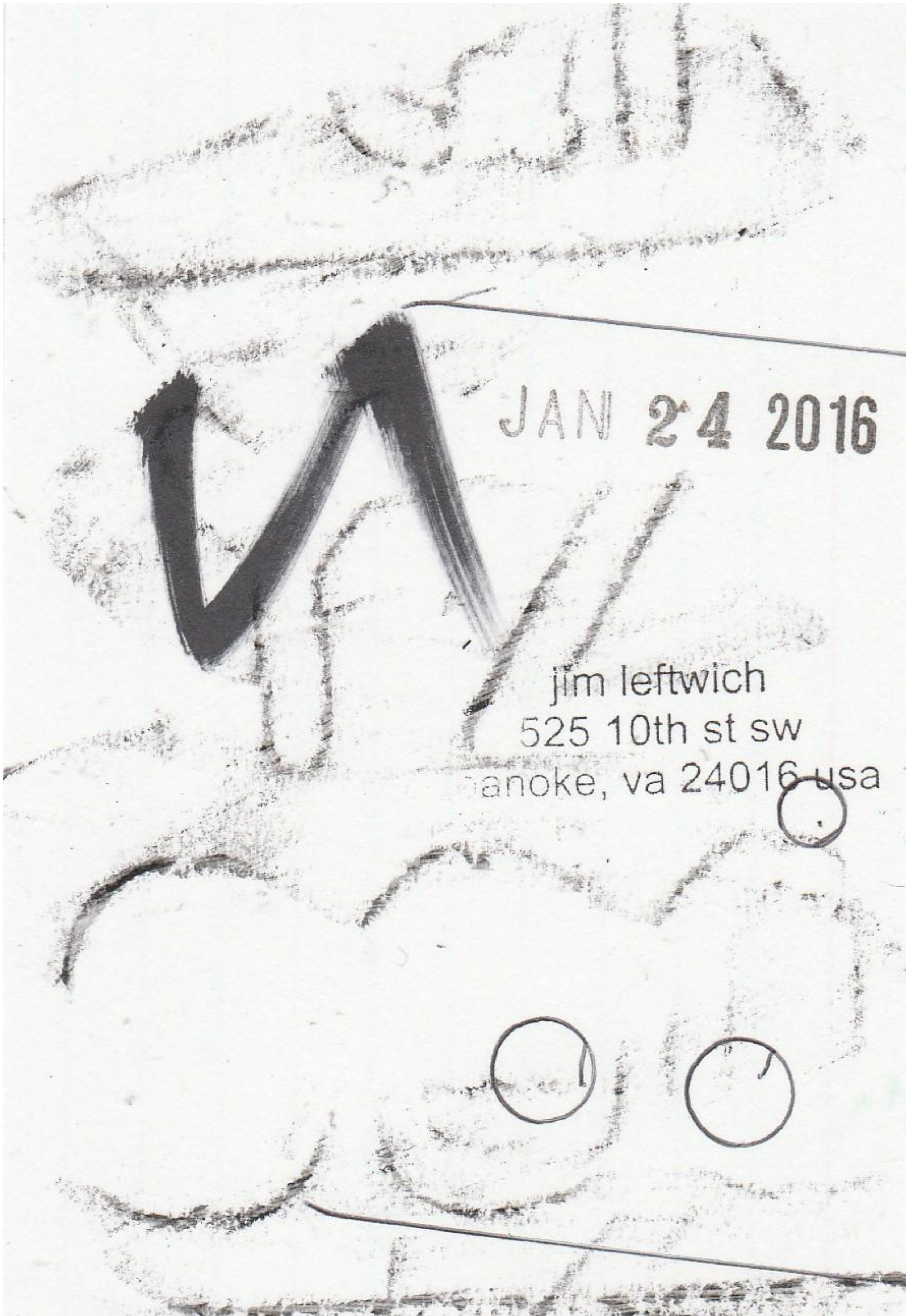
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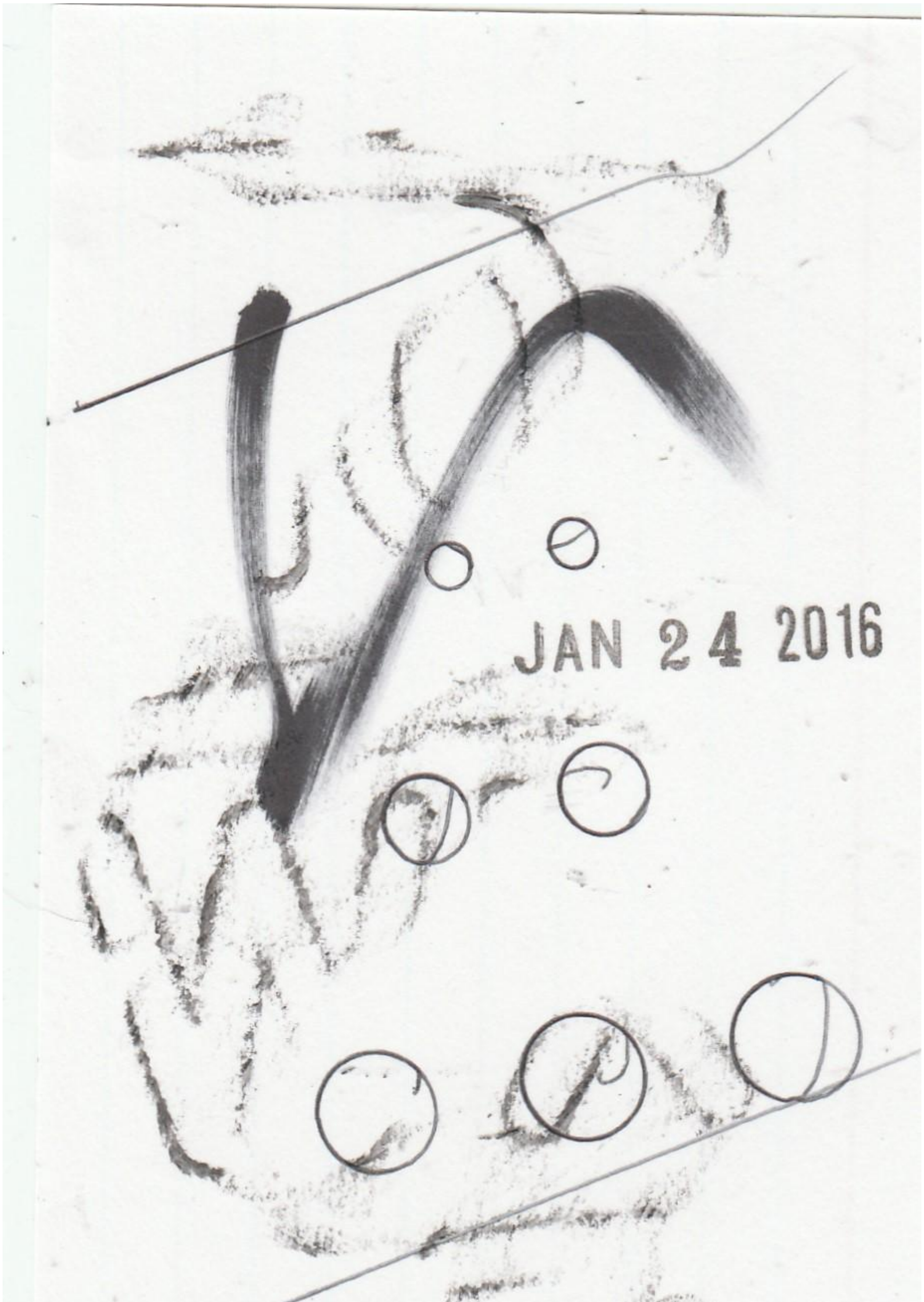

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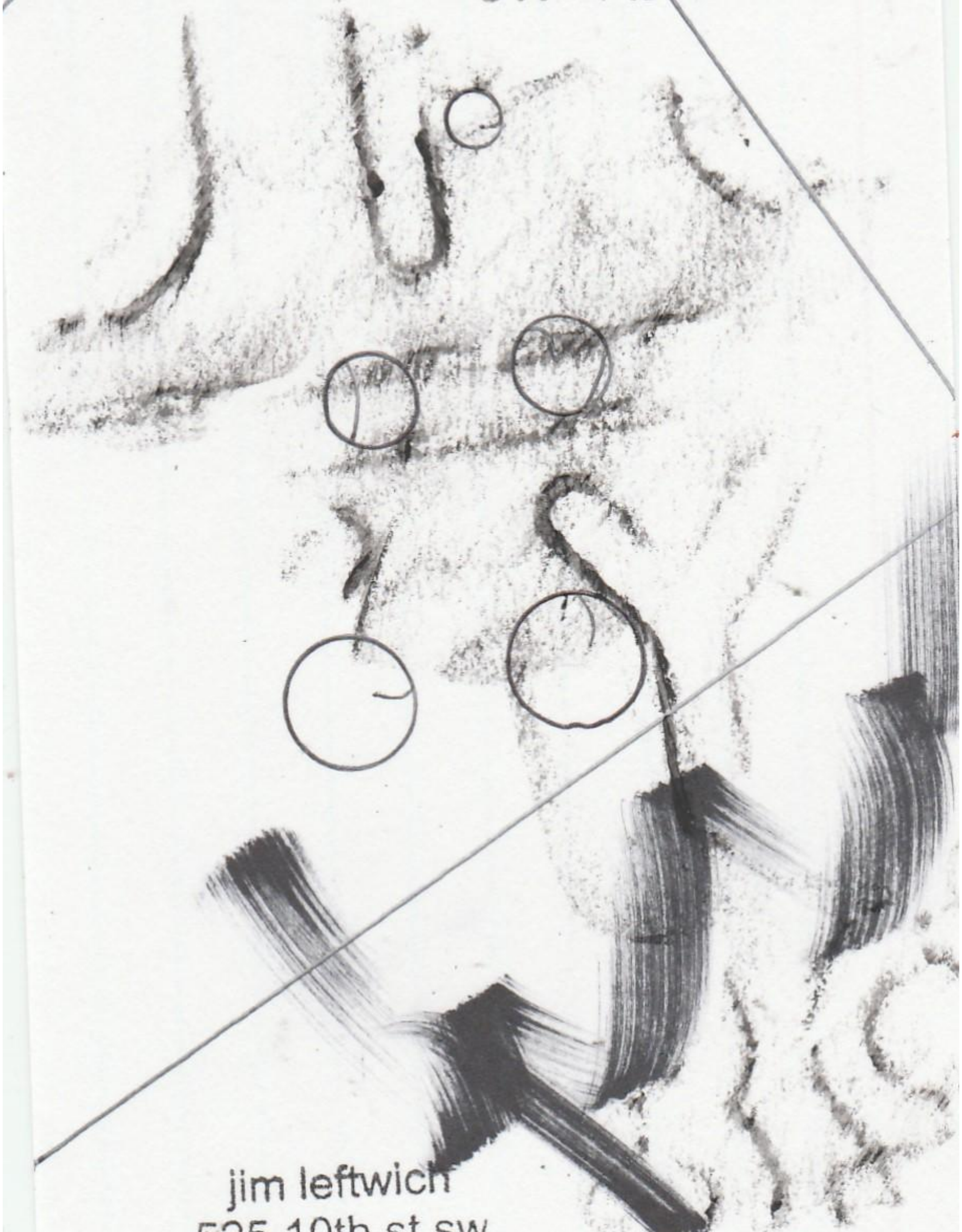

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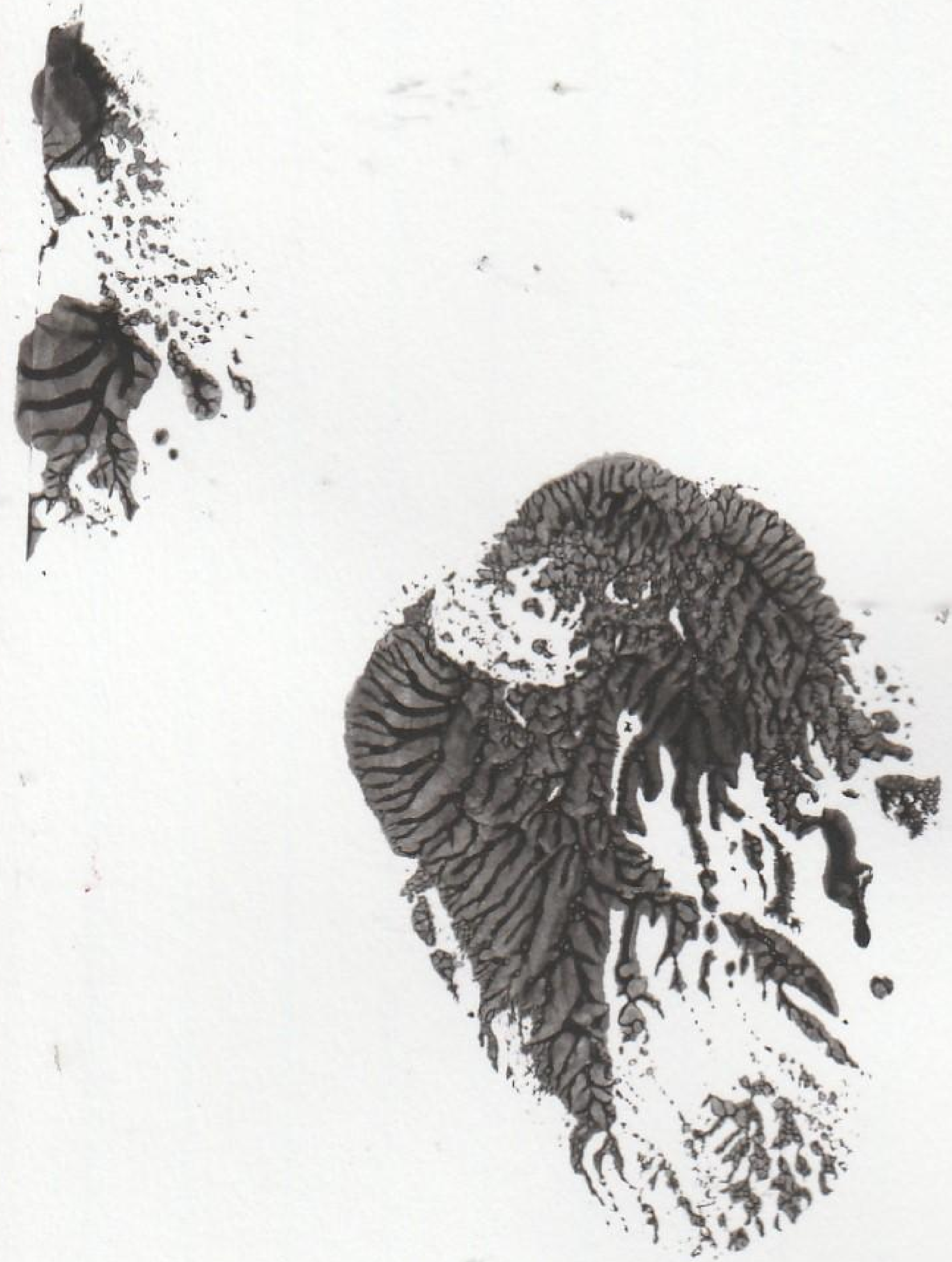

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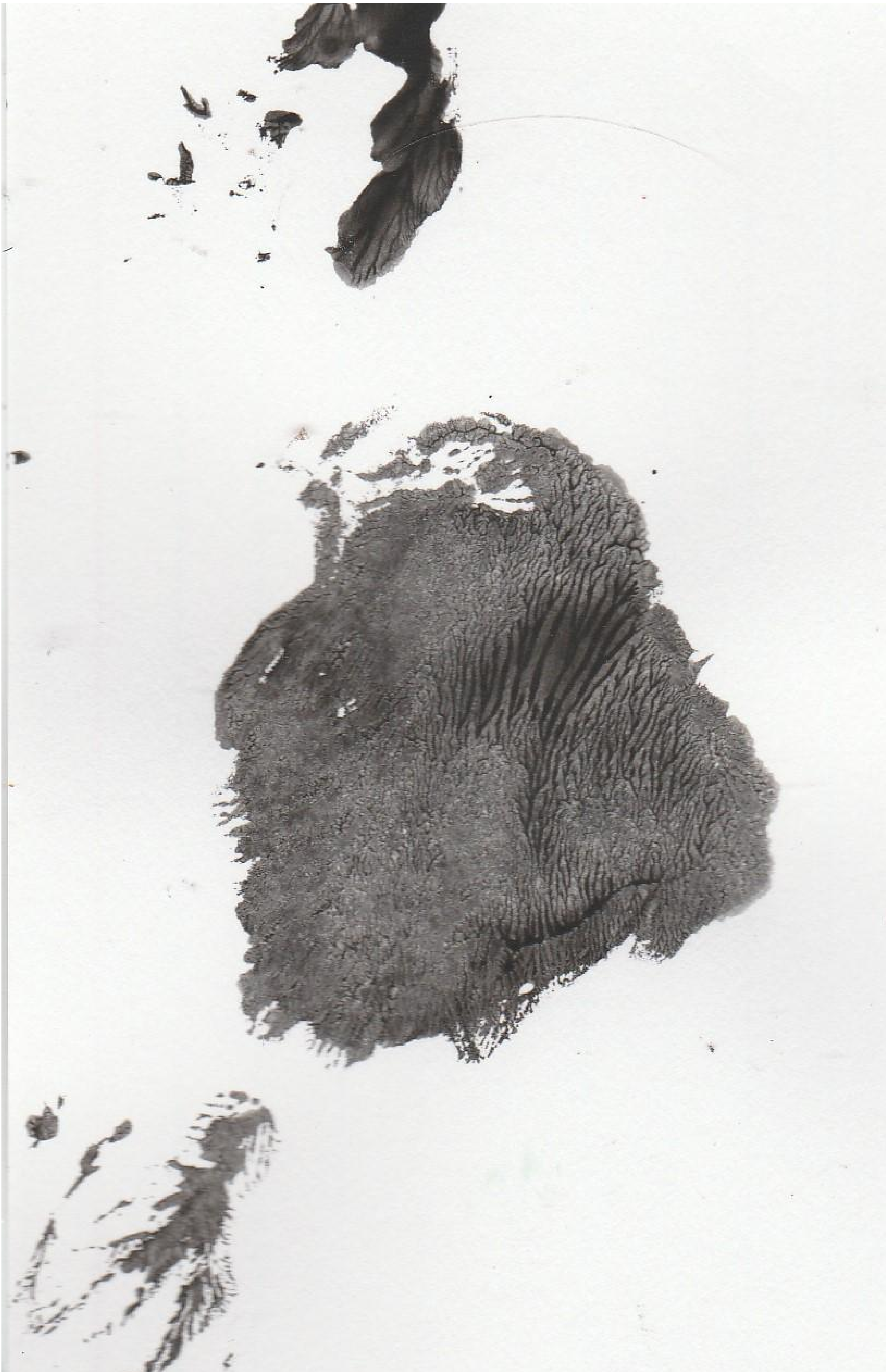

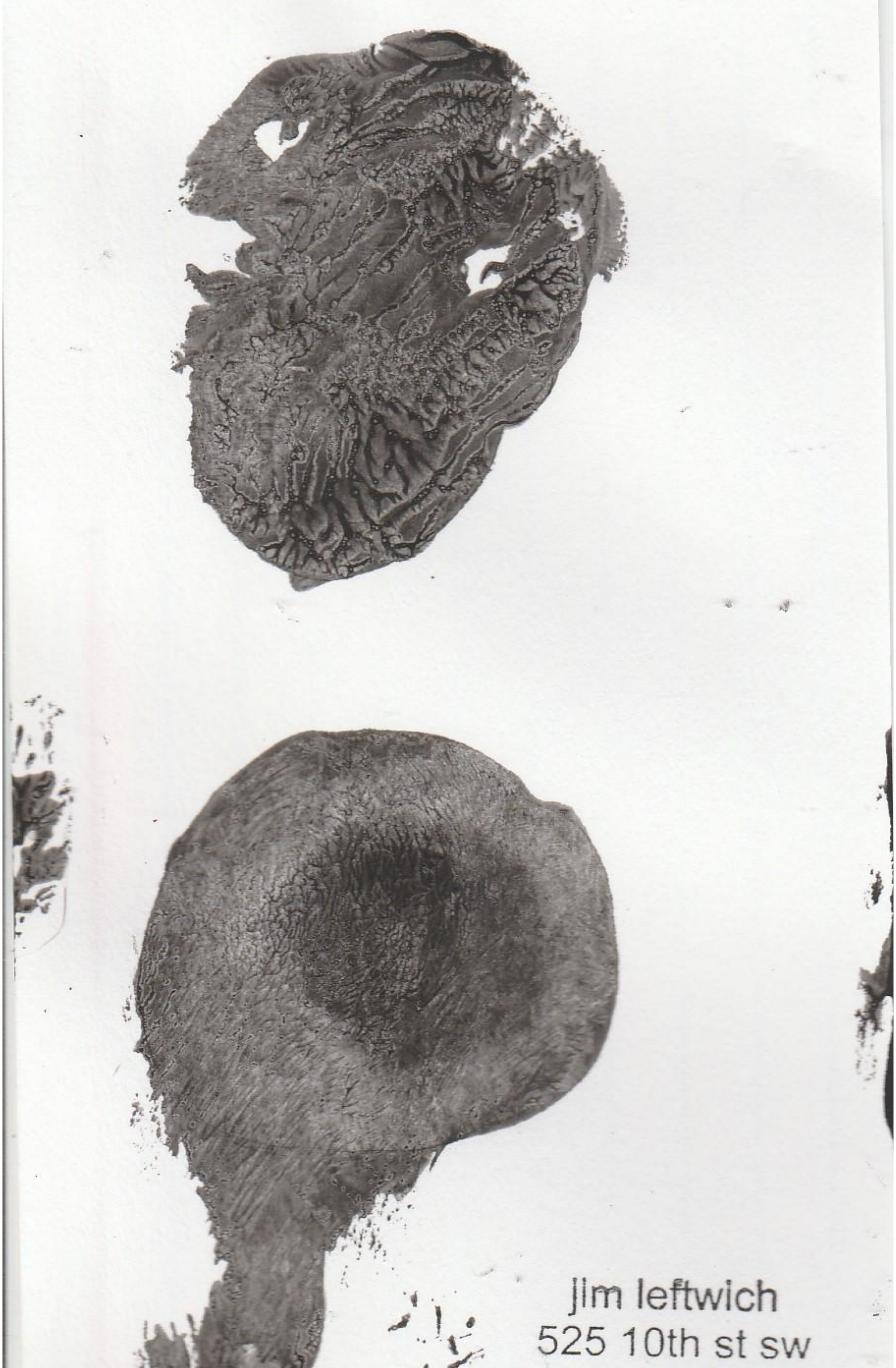
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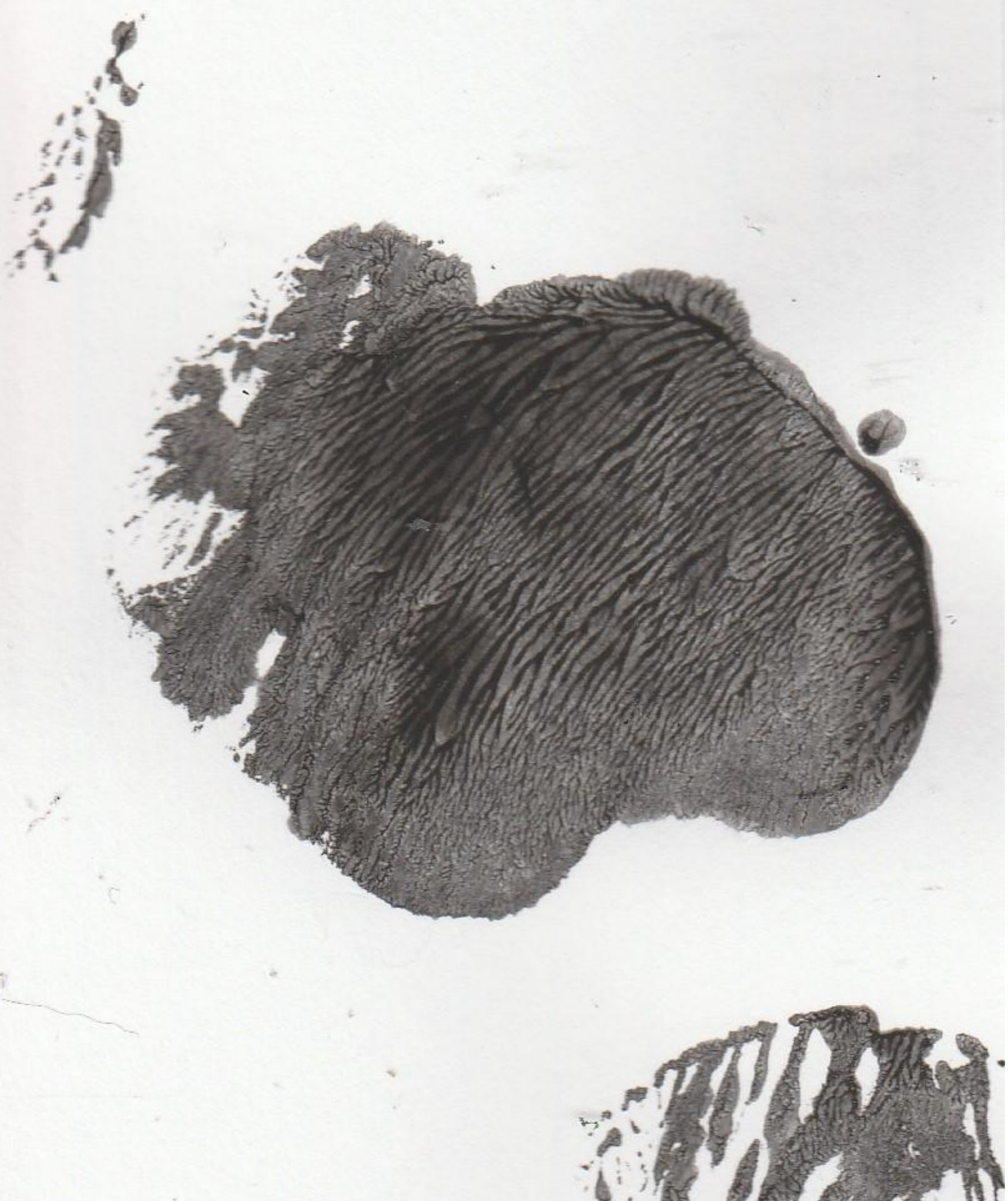

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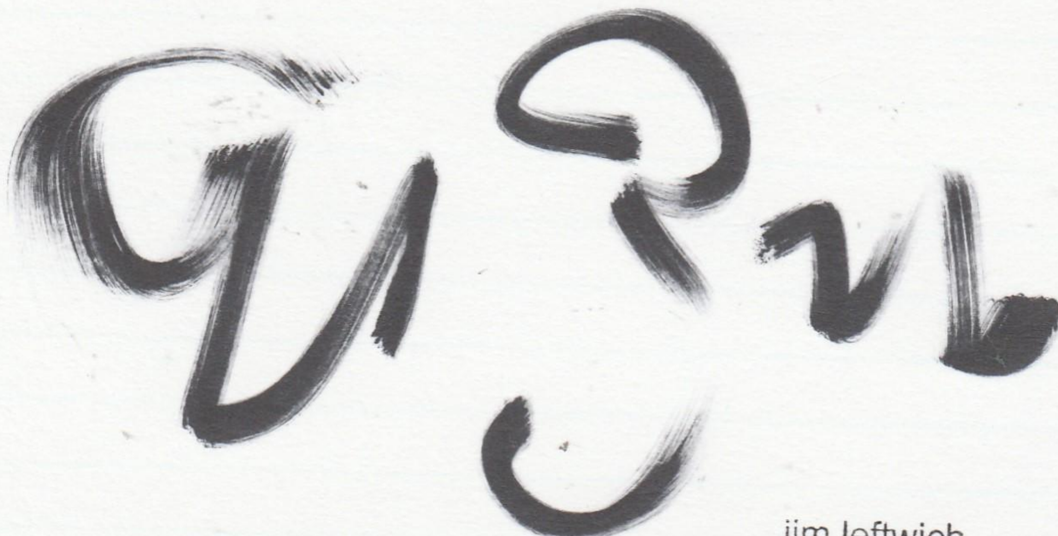

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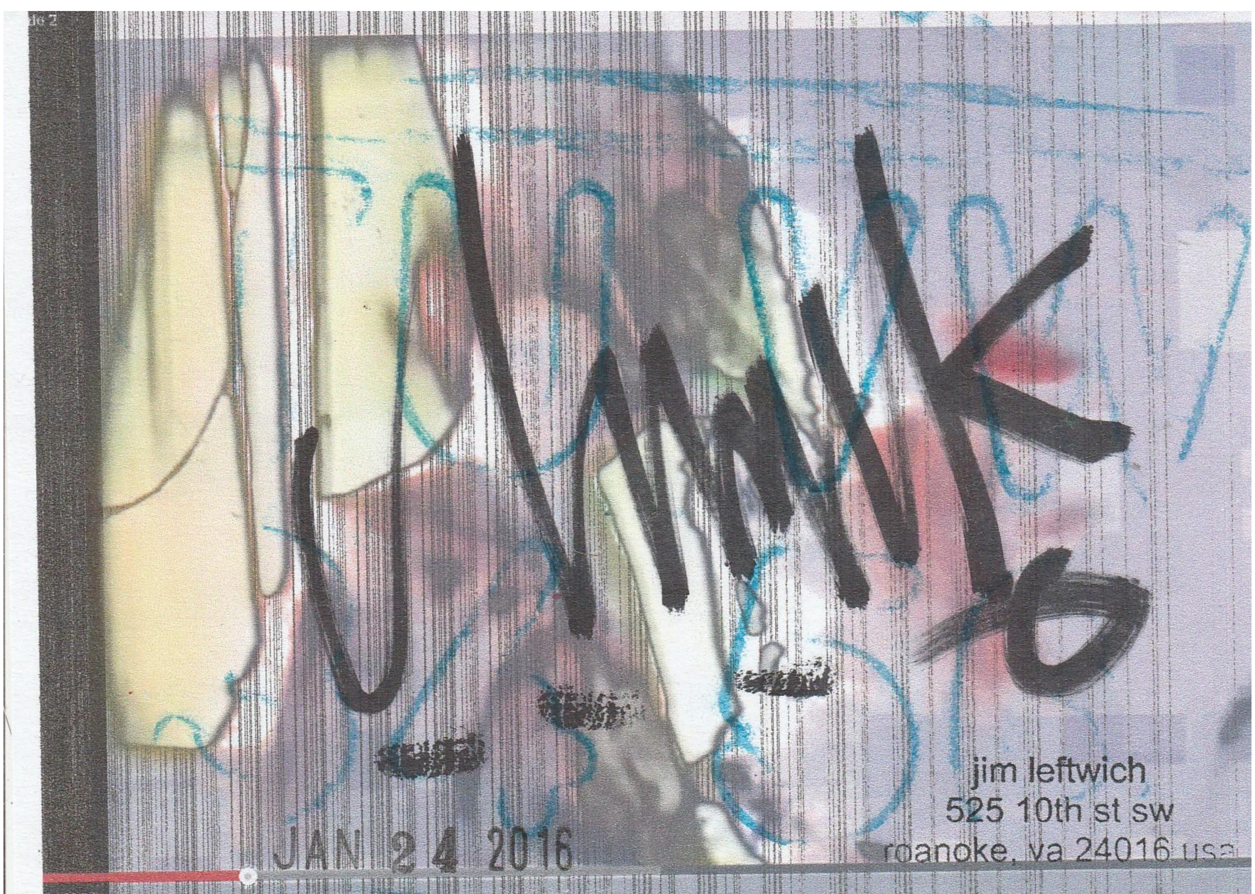
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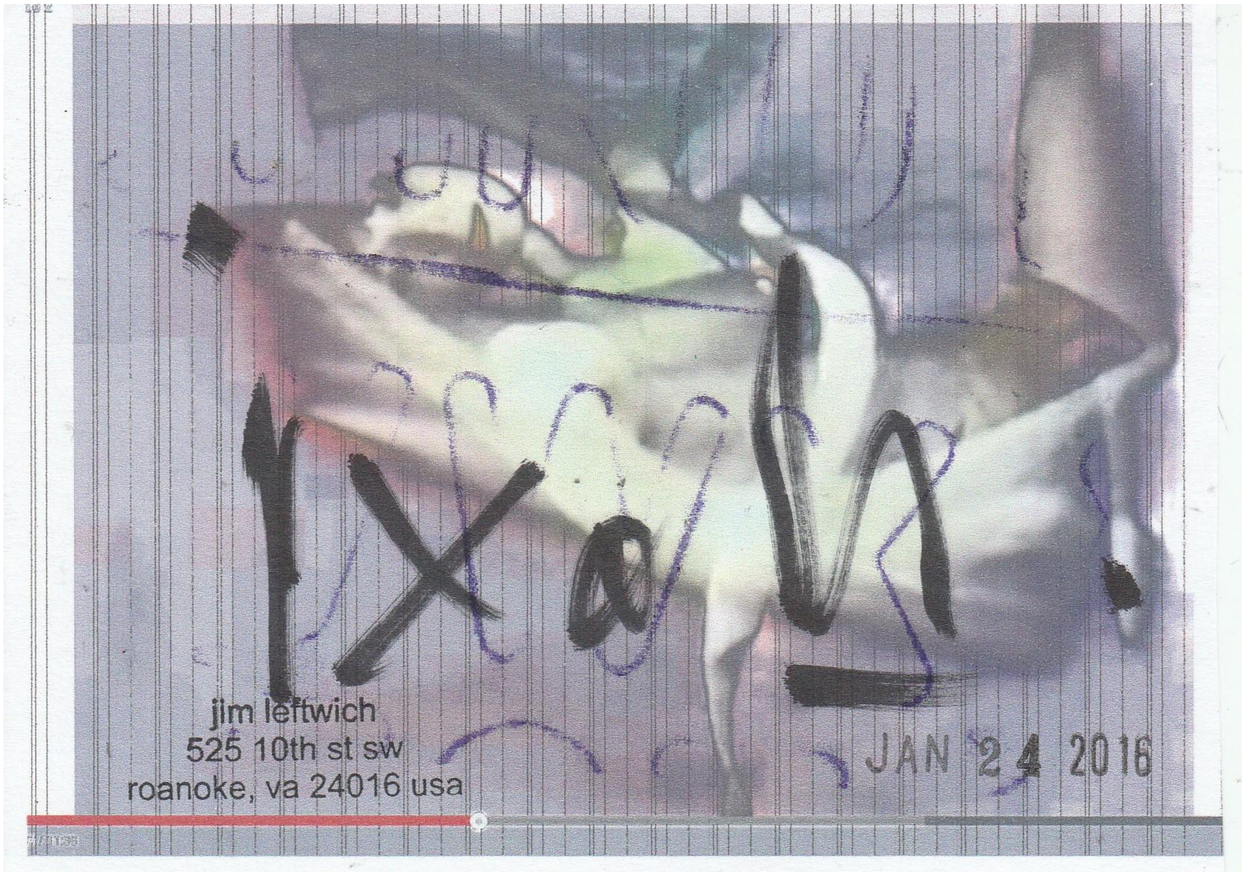
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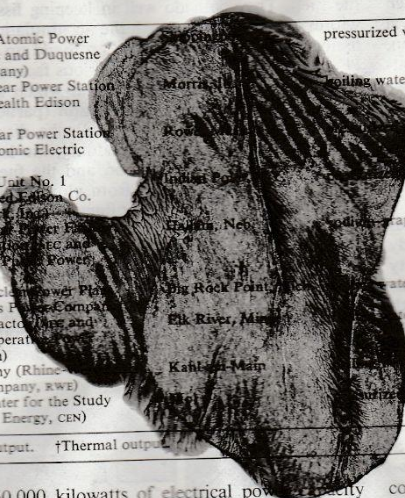
Table 5: Nuclear Electric Power Plant Prototypes (1962)

name and owner	location	type	power: plant kw (*) net	power: reactor kw (†)	start-up
Shippingport Atomic Power Station (AEC and Duquesne Light Company)	Shippingport	pressurized water	60,000	231,000	1957
Dresden Nuclear Power Station (Commonwealth Edison Company)	Morris, Ill.	boiling water	208,000	700,000	1959
Yankee Nuclear Power Station (Yankee Atomic Electric Company)	Rowe	[illegible]ter	161,000	540,000	1960
Indian Point Unit No. 1 (Consolidated Edison Co. of New York, Inc.)	Indian Point	[illegible]water	255,000	585,000	1962
Hallam Nuclear Power Facility, Sheldon Station (AEC and Consumers Public Power District)	Hallam, Neb.	sodium-graphite	75,000	240,000	1962
Big Rock Nuclear Power Plant (Consumers Power Company)	Big Rock Point, Mich.	[illegible]ater	47,800	157,000	1962
Elk River Reactor (AEC and Rural Cooperative Power Association)	Elk River, Minn.	[illegible]ter	20,000	58,200	1962
West Germany (Rhine-[illegible] Power Company, RWE)	Kahl-am-Main	[illegible]r	15,000	60,000	1960
Belgium (Center for the Study of Nuclear Energy, CEN)	[illegible]	[illegible]urized water	11,500	43,000	1962

*Electrical output. †Thermal outpu[illegible]



plant with 60,000 kilowatts of electrical po[illegible]city with steam to be sold to an electric-power company. The technology was derived largely from experience with the submarine thermal reactor.

The concept of a boiling-water reactor was derived from experiments at the Argonne National Laboratory with a small reactor that had been allowed to boil the water surrounding the core on a continuous basis, thus suggesting the possibility of direct coupling to a steam turbine instead of using hot pressurized water from the reactor to produce steam in a boiler separate from the reactor. The experiment had shown that if the control rods were abruptly removed, thus causing a sudden power expansion, the boiling water became steam so rapidly that the moderating effect of the water was lost and the chain reaction came to a stop long before the fuel elements were damaged.

The homogeneous reactor was to be based upon ea[illegible] experience at Oak Ridge. It would be slightly larger, and was intended to serve as a prototype for a still larger plant.

The sodium-graphite reactor was intended to combine the well-known graphite technology as the moderator with sodium cooling to achieve higher temperatures for more efficient power production, without the inconvenience of the high pressures associated with water cooling.

Finally, the potential advantages of a fast-breeder reactor were well recognized. With the success of the original experimental breeder reactor (EBR/-I), it was decided that the Argonne National Laboratory should build a larger version (the EBR-II), also to be in Idaho at the National Reactor Testing Station. It would be scaled up to about 60,000 kilowatts of heat with an electrical production of about 15,000 kilowatts. It would be loaded first with uranium-235 and later with plutonium in order to enable it to produce larger amounts of plutonium in the ura[illegible]nium blanket.

By the end of the decade, each of these five experimental reactors was operating and another had been added. A small reactor moderated with organic material had been tried because of its potential for producing fairly high steam temperatures at relatively low pressures. A major disadvantage, however, was the low heat-transfer properties of the organic material and its tendency to decompose and polymerize (combine two or more small molecules into large ones).

Except for the homogeneous-reactor concept, each of the experimental reactors led to the design and construction of industrial prototypes or demonstration reactors. Some of these plants were large enough to produce a significant amount of power, but there was still no proof that the costs could be made competitive with power plants burning fossil fuels.

The European Atomic Energy Community. Prompted largely by a growing shortage of coal and oil, the six Common Market countries of Europe in March 1957 ratified the establishment of the European Atomic Energy Community (Euratom). Earlier, representatives from West Germany, France, and Italy had visited the United States and had discussed plans for a nuclear power program in Europe. Their report, "A Target for Euratom," noted the growing dependence of Europe on energy imports and the crisis that the threatened closing of the Suez Canal posed to obtaining oil from the Middle East. With rising [illegible] and rising demand for electric power, they were [illegible]ic about the advent of nuclear power as a [illegible] Europe could become less dependent on [illegible] imports. They proposed that Euratom set a target of 15,000,000 kilowatts of installed nuclear power capacity to be built during the next [illegible] years. Found-ing of Euratom

It appeared, therefore, [illegible] the conditions for nuclear power [illegible] were more favourable than those in [illegible] and indeed that European experience [illegible] a proving ground from which American power reactor development could benefit.

[illegible] expectations were [illegible] realized, partly because of the [illegible] availability of [illegible] the discovery of new oil [illegible] reserves. France [illegible] beginnings of a nuclear-power industry based upon the dual-purpose graphite-moderated, carbon-dioxide-cooled-reactor approach. Italy [illegible] negotiations to buy plants from both the United States and the United Kingdom and was the first to pro-[illegible] nuclear-power plant of substantial size to be built under arrangements between Euratom and the United [illegible] initial [illegible] however, fell far short of what [illegible]zed. The Euratom proposal was [illegible] by utility companies, and the [illegible] and availability of nuclear fuel, [illegible] nuclear-liability insurance, together [illegible] costs, discouraged the switch from fo[illegible]

By [illegible] after Euratom's founding, two firm Euratom [illegible] projects, and a third underway, provided altogether about 700,000 kilowatts of capacity. Obviously the earlier goal was not to be achieved, and there had been only a beginning in the development of an international market for nuclear-power equipment. During the same period, Japan, with its dependence on fuel imports, recognized the potential advantages of nuclear power and began to explore the possibility of purchasing both nuclear

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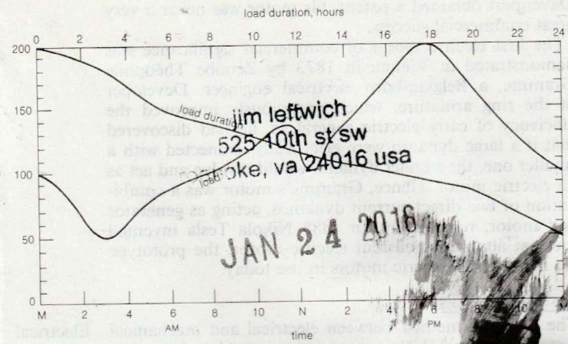

Figure 31: A smoothed version of the load curve of F[illegible] together with a load duration curve, indicating the number of hours each day that a particular load is exceeded.

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For most economical operation the base load portion should be supplied by the power stations the operating costs of which are lowest; for example, by run-of-river-flow-type hydroelectric stations, by the most efficient thermal power stations in the system, and, increasingly, by nuclear power stations. The peak load portion should be supplied by power stations the construction costs of which are low. Peak load is relatively high in kilowatts but relatively short in duration, so that total kilowatt-hours are not great. Peak load may be supplied by pumped-hydro stations, old thermal power stations, and gas-turbine stations.

Pumped hydro requires no [illegible] for pumping the water to the sto[illegible]

Figure 32: Typical load duration curves for a one-year period, showing how base load can be substantially increased (right) by using power during periods of low demand to operate a pumped storage system (see text).

can be used for pumping, raising the level of base load (see Figure 32, right). The middle load is then supplied by older type thermal stations. To accommodate starting and stopping of turbines once or twice a day, thermal stations are designed especially for [illegible] middle-part use. Effective system planning requires estimates of future changes in the percentages for the three types of load.

INTERCONNECTION

Factors in planning the capacity of a system

To determine how much generating capacity should be built into a power system, a number of factors must be considered. Foremost is the maximum peak load on the system. Emergency conditions (*e.g.*, a fault in a [illegible] station or in transmission lines) must be consi[illegible] as well as scheduled outages for regular repair and [illegible]. To provide the necessary reserve ma[illegible] normal peak power requirements, a certain re[illegible] quired, sometimes expressed as 15 percent [illegible] and sometimes by the total of the two largest [illegible] system. Each system must be considered indiv[illegible] capacity of the largest generating unit is normall[illegible] to 10 percent of the total system capacity.

The investment cost of generating capacity per kilowatt is usually lower as unit size increases, making the use of larger units economically beneficial. In a small system, however, such benefits cannot be realized. Larger systems can be assembled by interconnecting two or more smaller systems, thus enabling the use of a larger generator unit. Interconnections must be designed to give an adequate power flow through interconnecting lines in an emergency. If help from neighbouring systems can be counted on in case of emergency, as can be realized by interconnection, reserve margins can be reduced, resulting in considerable economic benefits.

Interconnection also has economic advantages in day-to-day utility systems operations. Where system load conditions would normally require the operation of a generating station with a relatively low efficiency if the system were operating independently, interconnection can cut fuel costs by making use of more efficient generators from a neighbouring system. Another advantage of interconnection is the flexibility it allows in choosing sites for new generating stations; planning takes into consideration the interconnected systems as a whole, rather than a single independent system. Because of these advantages, electric-power systems have grown [illegible] result of interconnection between [illegible] and even interconnections between [illegible].

Interconnection introduces [illegible] that must be solved in system [illegible]. Tie-line power flow, for example, in [illegible] to neighbouring electric power s[illegible] controlled in the day-to-day operation [illegible] nected system. Such power flow is normally [illegible] on a contractual basis between the [illegible]. The complexity of systems with interconnections at many points and at various voltages, however, creates difficult problems, for the solution of which the analog computer has been used since the 1930s. Such computers, known as ac calculating boards, network calculators, or network analyzers, have proved to be effective tools for solving power flow problems in interconnected system operation and planning. In the late 1960s they began to be replaced by digital computers, which have gr[illegible] flexibility. In many instances on-line co[illegible] is used for the operation of large inter[illegible].

Importance of reliable communications

In addition to the normal [illegible] tele-phone and radio, a util[illegible] complex network for telemeteri[illegible] control functions. Extensive [illegible] wire circuits, carrier teleph[illegible]. In carrier telephony the [illegible] for high-frequency waves.

As a power system gro[illegible] dis-turbances increases propor[illegible] the rupturing capacity of all circ[illegible] be increased. A circuit breaker w[illegible] capacity may explode when a sys[illegible]. One way to alleviate the problem is to intro[illegible] reactance (a circuit component that impedes the flow of alternating current) into the system to reduce the fault current. Such reactance causes a voltage drop in the system during normal operation, however, and so has drawbacks. Connecting two systems with a dc linking device is also a possibility. No ac fault current flows through the dc link-ing device; thus fault current is restricted to one system.

Potential of large-scale power outages

Another problem with interconnected systems is the possibility of a large-scale blackout if there is a system fault. Power systems are designed so that a fault can be located almost instantly and the faulted section switched out in a very short time, thus allowing stable operation of the rest of the system, whatever the nature and location [illegible]

Power system design is usually on a single contingency [illegible] operation two or more contingencies [illegible], perhaps leading to a wide-[illegible] of power. Weather disturbances may [illegible] transmission lines, while an error on the part [illegible] patcher, or failure of a protective apparatus [illegible] circuit breakers), cannot be excluded. Thus, [illegible] spread blackouts, such as that of November 1965 in the northeastern United States and southeastern Canada, can occur. Much can be learned from such large-scale power failures. First, reserve capacity, to be effective in an emergency, should be a spinning reserve; that is, the equipment must be in such a state that the output capacity can be used very soon after the disturbances. The time needed to produce electricity from a thermal station

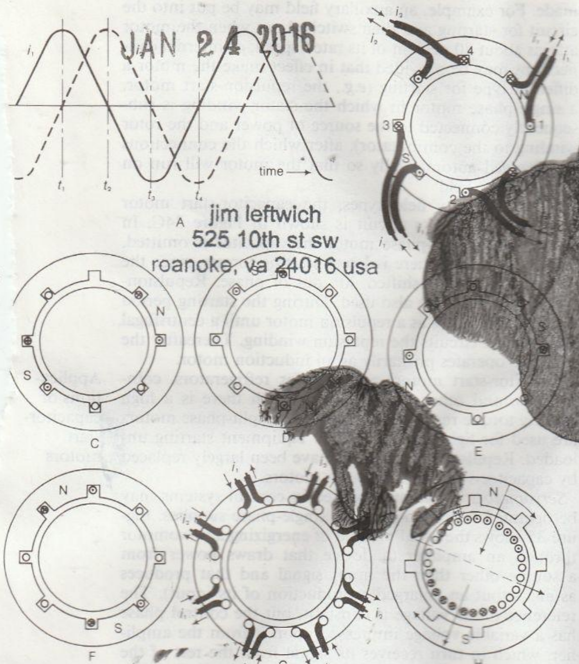

Figure 33: Induction motor fields and their interaction with rotor and stator conductors. ⊙ indicates that the flow of current is directed toward viewer, perpendicular to page; ⊗ current is directed away from viewer (see text).

zero—are the same but whose phase relationship is 90°. Figure 33B shows schematically a stator on which four coils have been wound; coils 1 and 3 are so connected that if the current i_1 is in the direction shown, the polarities of the magnetic field at the stator surface will be north at the upper and south at the lower coils. When the current reverses, so do the polarities of the fields. Coils 2 and 4 are also connected so that a current i_2 produces a similar field. As shown in Figure 33A, at a given instant of time t_1, i_1 is a maximum and i_2 is zero. Under these conditions the field situation is as shown in Figure 33C. A quarter-period later, at t_2, the current i_1 is zero, and i_2 has risen to a positive maximum. The resulting field conditions are now as shown in Figure 33D. At a third instant, t_3, i_1 has advanced to a maximum, but in the negative sense, while i_2 has fallen back to zero from a positive maximum. The field situation is now that of Figure 33E. Finally, at t_4, i_1 has again become zero and i_2 has reached a negative maximum, and Figure 33F shows the resulting fields. The north [illegible] is found to travel around the periphery of the stator [illegible] one complete revolution while the current goes [illegible]. Hence a revolving field is produced, and [illegible] depends solely upon the geometry of the coils and [illegible] required for one cycle. [illegible] hertz power supply, [illegible] revolutions will be made per second, or [illegible] revolutions in one minute. [illegible] the revolving field is known as the synchronous [illegible].

If each coil is reduced in size so that it spans half the stator surface (Figure 33G), the revolving field will travel only half as far for each cycle of the supply current, and the speed of the revolving field will become 1,800 revolutions per minute for a 60-hertz [illegible]. The coil arrangement of Figure 33B is said to produce a two-pole motor, since at any instant there is but one north and but one south pole. The arrangement of Figure 33G, on the other hand, will produce two north poles and two south poles at any instant and therefore is a four-pole stator. It is not uncommon to have as few as two or as many as 100 poles in a motor. The speed of the revolving magnetic field in revolutions per minute in any motor is 120 f/p, in which f is the frequency in hertz and p is the number of poles.

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In a practical motor the stator will have more coils than indicated here, and these will be distributed around its periphery in equally spaced slots. This arrangement makes better use of the available space than does the concentrated-coil arrangement described above, but the result is still the same—a revolving field is established.

[illegible] conductors is uniformly spaced around the periphery of a rotor, as shown in Figure 33H, and if the rotor is [illegible] and a two-pole revolving field is located in the position shown, a voltage will be induced according to Faraday's law [illegible] direction out of the page in the upper conductors and into the page in the lower conductors. If these conductors are now short-circuited through a slip ring—a device for making electrical connections between stationary and rotating contacts—currents will flow in the same direction as the induced voltages. These currents in turn will produce their own magnetic field, and its direction will be shown by the dashed line in Figure 33H. The north pole of the rotor and south pole of the stator will attract each other, and a torque will be exerted on the rotor tending to turn it in the direction of the rotating field.

If the rotor is travelling at the same speed as the revolving field, there will be no induced voltage in the conductors, no current flow, and no torque. Hence, at synchronous speed the torque drops to zero. If the rotor travels faster than synchronous speed, the direction of the induced voltage and the current will be reversed, thus reversing the torque; the motor is now serving as an induction generator.

Construction features. The rotor and stator are built up of laminations of 0.25 percent [illegible] percent silicon steel, from 0.014 to 0.025 inch [illegible] metre) thick. The laminations are [illegible] insulating varnish to reduce the [illegible] induced in the laminations (eddy-cu[illegible] [illegible] distributed slots are punched in the [illegible].

The coils (usually the stator [illegible] which are connected to the external energy source [illegible] and insulated and then inserted into the slots, or the conductors may be placed directly into the slots and the insulation applied afterward. The former technique is presently used for motors rated at more than 600 volts or about 100 horsepower.

The conductors that form the secondary winding may be of three types: wound, squirrel-cage, or solid. To make the wound type, a two-phase winding (having a phase difference of [illegible] degrees, or one quarter [illegible] phase winding (differing in phase [illegible] or 120 degrees) is placed in the [illegible] the terminals are brought out [illegible] brass or bronze rings on which [illegible] provide an electrical connection [illegible]. The squirrel-cage winding may be either cast from aluminum or copper or built up from copper or brass bars welded to a common end ring. To cast such a winding, a stack of rotor laminations is inserted in a centrifugal casting machine and molten aluminum or copper is introduced. The result, after the metal solidifies, is an integrally [illegible] longitudinal conductors and two end rings. The [illegible] generally is used for standard production line [illegible] sizes under 100 horsepower; [illegible] larger motors [illegible] welded-bar type is more co[illegible]

Types of secondary windings

[illegible] example of the solid or continuous winding is the [illegible] motor, in which a [illegible] rotated [illegible] magnetic field to generate [illegible] pro[illegible] to its speed. A solid copper [illegible] on [illegible] steel will also provide [illegible] conduc-[illegible] Continuous-winding rotors are [illegible] principally for servomotors.

Polyphase induction motors. [illegible] phase stator connection is by far the most common, because most industrial power distribution systems are three-phase. In this type of motor the revolving field is produced by three different currents whose phase relationships are 120° instead of the 90° shown in Figure 33A.

Both squirrel-cage and wound-rotor motors may be used in polyphase service; however, the latter are usually re-


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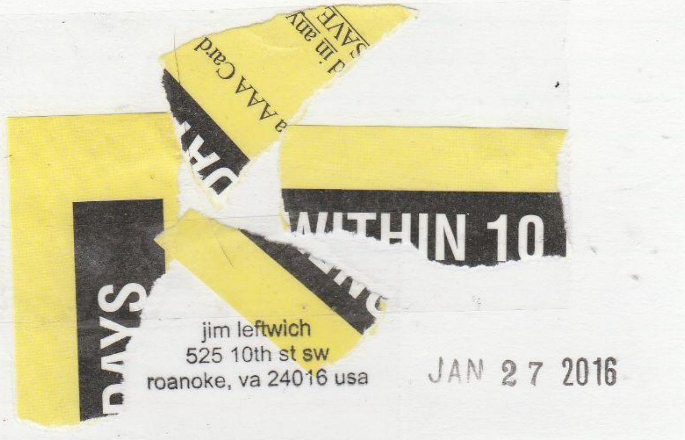
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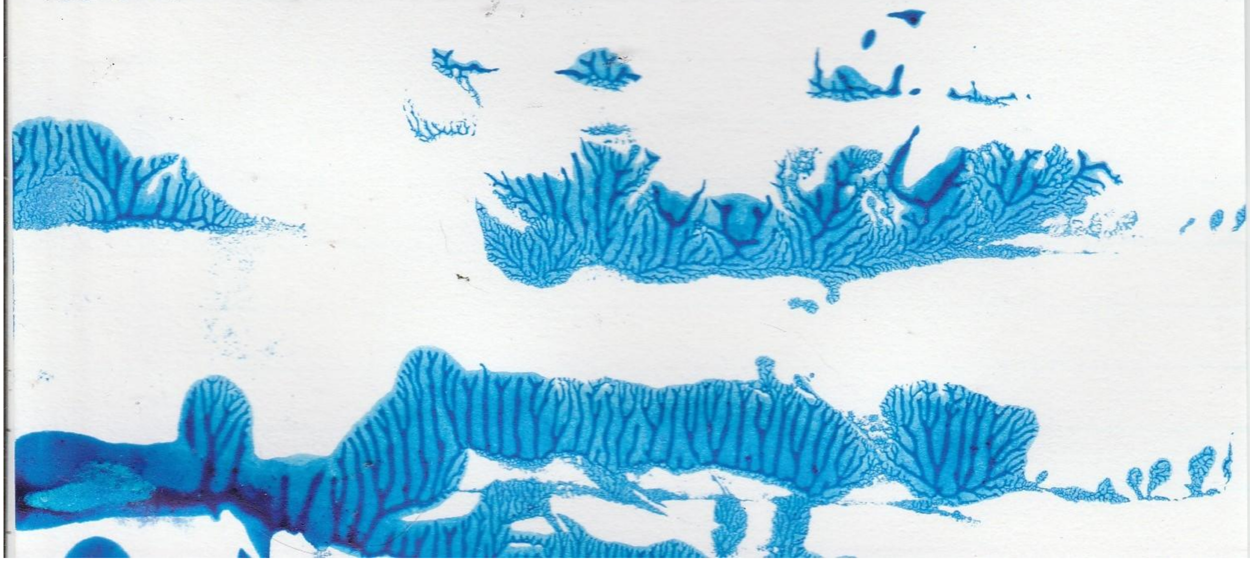

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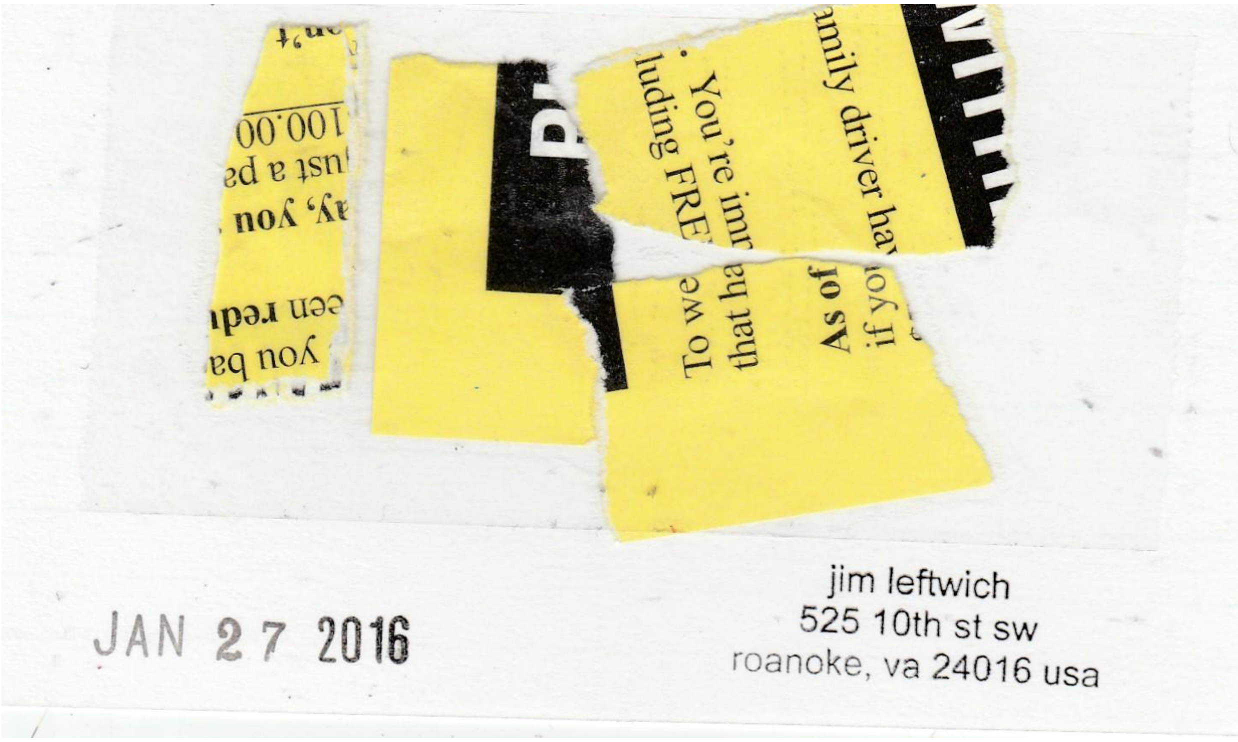
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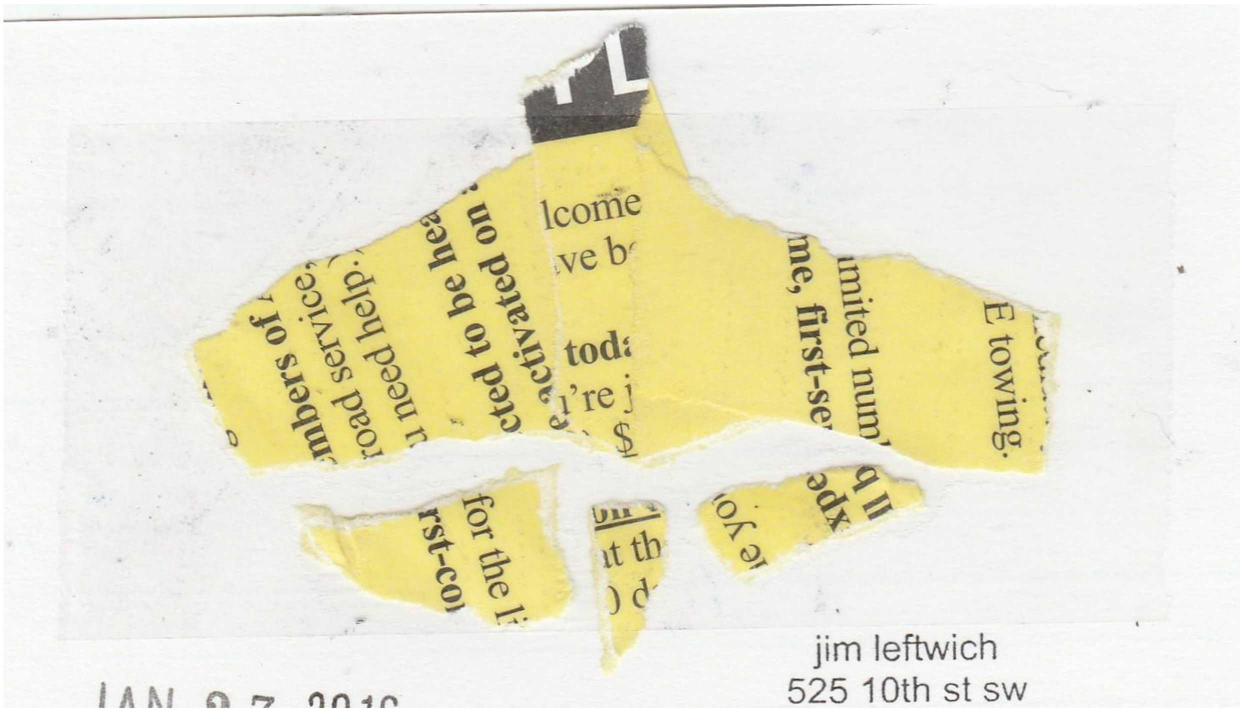
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operant
ABC
omnivorous
zoology.
plant and animal foods.
The bear is an OMNIVOROUS animal.
ontogeny \än-ˈtäj-ə-nē\ n.
BIOLOGY. All the phases in the development of an individual organism. see phylogeny.
The ONTOGENY of human embryos appears to recreate the evolutionary history of the animal kingdom.
BEAR
OMNIVOROUS
oogenesis \ˌō-ə-ˈjen-ə-səs\ n.
BIOLOGY. The process of egg formation, including the production of an ovum from special body cells by meiosis and mitosis and the preparation of the ovum for fertilization and development. Oogenesis is comparable with spermatogenesis in males.
During the OOGENESIS of chicken eggs, considerable yolk is stored in the cytoplasm.
opaque \ō-ˈpāk\ adj.
Referring to the property of a substance that does not transmit light; also, referring to a substance that is impervious to other forms of radiation besides visible light.
Limestone, wood and iron are OPAQUE substances.
opalescence \ˌō-pə-ˈles-ᵊn(t)s\ n.
EARTH SCIENCE. The property of certain translucent minerals or gems that reflect an iridescent light or that have a milky iridescence.
The OPALESCENCE of some minerals makes them highly prized as gems.
WATER
MERCURY
OPAQUE
open circuit \ˈō-pən ˈsər-kət\
PHYSICS. A loop, or path, made of a good electrical conductor that would carry an electric current except for a break or gap in the conductor.
An OPEN CIRCUIT is the result when a light switch is turned to "off."
operant \ˈäp-ə-rənt\ adj.
Referring to something that is functioning effectively; also, referring to something that it is possible to observe and to measure.
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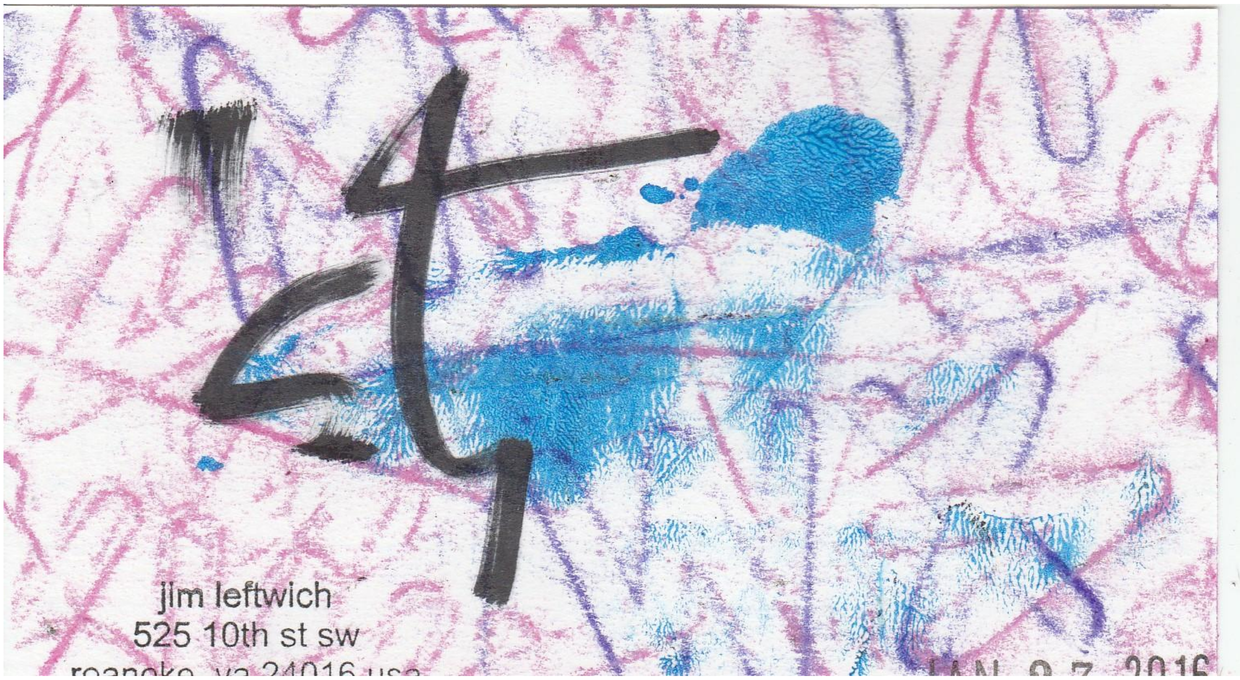
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